



Addition to “An updated phylogeny, biogeography, and *PhyloCode*-based classification of *Cornaceae* based on three sets of genomic data”

ZHI-YUAN DU^{1,2}, QIU-YUN JENNY XIANG^{1*}, PAMELA S. SOLTIS³ & DOUGLAS E. SOLTIS^{3,4}

¹Department of Plant and Microbial Biology, North Carolina State University, Raleigh, 27695 NC USA

✉ jenny_xiang@ncsu.edu; <https://orcid.org/0000-0002-9016-0678>

²Wuhan Botanical Garden, Chinese Academy of Sciences, Wuhan, 430074, China

✉ zydu@wbgcas.cn; <https://orcid.org/0000-0003-4016-3878>

³Florida Museum of Natural History, University of Florida, Gainesville, 32611 FL USA

✉ psoltis@flmnh.ufl.edu; <https://orcid.org/0000-0001-9310-8659>

⁴Department of Biology, University of Florida, Gainesville, 32611 FL USA

✉ dsoltis@ufl.edu; <https://orcid.org/0000-0001-8638-4137>

*Corresponding author

Abstract

Du *et al.* (2023) produced a phylogeny of *Cornus* L. using three sets of genomic data, proposed a classification within the clade, and phylogenetically defined 13 clade names following the *International Code of Phylogenetic Nomenclature (PhyloCode)*. However, the clade names were not fully established because no registration numbers were cited in the protologues, as required by the *PhyloCode*. That omission is remedied here, and expanded protologues are provided for the 13 names defined by Du *et al.* (2023). Ten of the 13 names are the same as those proposed by Du *et al.*, (2023), while three names proposed by Du *et al.* (2023) are changed here (*viz.*, *Involucry* to *Involucratae*, *Bractishowy* to *Bractipetaloides*, and *Eurasiancherry* to *Eurasiamacropium*).

Key words: dogwoods, clade names, phylogenetic nomenclature, registration

Introduction

Du *et al.* (2023) recently conducted a phylogenomic analysis of *Cornus* L. (Linnaeus 1753) and proposed a classification based on the resulting phylogeny. Thirteen strongly supported clades were named following the *International Code of Phylogenetic Nomenclature (PhyloCode; Cantino and de Queiroz 2020)*, but the clade names were not fully established because no registration numbers were cited in the protologues. Therefore, it is necessary to register the clade names in accordance with the *PhyloCode*. Here the 13 strongly supported crown clades within and including *Cornus* are formally named using 11 preexisting names and two new names. For each clade, the name, registration number, phylogenetic definition, composition, and diagnostic apomorphies/features are provided. The two new names are revised from those proposed by Du *et al.* (2023) for Latinization and better descriptive accuracy. Ten preexisting names proposed by Du *et al.* (2023) are unchanged here, but one new name proposed by Du *et al.* (2023) is replaced here by a preexisting name that was overlooked by them. This addendum should be consulted alongside the original publication (Du *et al.* 2023).

Clades and Their Synapomorphies

All clades are strongly supported in the phylogeny by three sets of genomic data in Du *et al.* (2023). In only one case, *Cynoxylon*, monophyly was not supported by the plastid genome phylogeny. We addressed the conflict in the “Comments” section for *Cynoxylon* (see below). All names established here have minimum-crown-clade definitions. We propose to use informal panclade names (e.g., pan-Syncarpea), which are not capitalized or italicized, to refer

to the total clades of these clades within *Cornus*, and pan-*Cornus* for the total clade of *Cornus*. Some of the clades have clear synapomorphies while others do not, although they have diagnostic features. The synapomorphies, putative synapomorphies, or diagnostic features are provided briefly for each clade. More detailed discussion and comparison of morphologies among clades are provided in Du *et al.* (2023).

***Cornus* C. Linnaeus 1753 (1): 117 [Z-Y. Du, Q-Y. Xiang, P. S. Soltis, and D. E. Soltis], converted clade name**

Registration Number: 767.

Definition: The smallest crown clade containing *Cornus sanguinea* Linnaeus 1753, *C. mas* Linnaeus 1753, *C. canadensis* Linnaeus 1753, and *C. florida* Linnaeus 1753.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Cornus* comprises 51–57 species in the Old and New World, with most in the North Temperate regions, one species in eastern Africa, and three species in Mexico, Central and South America (<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:330228-2>; Wangerin 1910; Xiang and Boufford 2005; Murrell and Poindexter 2016).

Diagnostic Apomorphies: Plant synoecious (except the African species *C. volkensii* Harms, which is dioecious). Leaves simple, entire, opposite (rarely spiral—in the two species of clade *Mesomora*) with arcuate venation and 2-armed hairs that are usually appressed, but sometimes raised as V- or Y-shaped (at least when young); when leaves spiral, fruit stone apex with a cavity; flowers 4-merous with distinct and reflexed petals and minute sepals; inflorescences usually terminal, rarely lateral—in *C. chinensis* Wangerin; fruit drupaceous, usually from a 2-carpellate inferior ovary, rarely from a 3- or 4- carpellate ovary (i.e., in *C. oblonga* Wall.).

Comments: In Du *et al.* (2023), we adopted the narrow concept of *Cornaceae* that includes only the broadly circumscribed *Cornus* containing the four morphological subgroups included by Linnaeus (1753). We use *Cornus* with a minimum-crown-clade definition for the crown-clade. The name *Cornus* L. 1753 has been widely and consistently used for this crown clade (Wangerin 1910; Eyde 1987, 1988; Xiang and Boufford 2005; Murrell and Poindexter 2016), while the name *Cornaceae* Berchtold & J.Presl 1825 has been only occasionally used for the clade, i.e., when the family *Cornaceae* was defined to include only *Cornus* (e.g., Du *et al.* 2023; Taktajian 1980). *Cornaceae* has been generally used for a more inclusive clade containing *Cornus* and additional genera, such as *Alangium*, *Mastixia*, *Nyssa*, *Davidia*, and *Camptotheca* (e.g., Edye 1988; Chase *et al.* 1993).

The monophyly of *Cornus* is strongly supported by both molecular and morphological evidence (Murrell 1993; Xiang *et al.* 1993, 1998, 2006, 2011; Fan and Xiang 2001; Fu *et al.* 2019; Thomas *et al.* 2021). Four well-supported major clades within *Cornus* are clearly distinct in inflorescence and fruit morphology: (1) the blue, white, or black-fruited dogwoods with elongated and expanded compound cymose inflorescences bearing rudimentary bracts that are often early-deciduous; (2) the cornelian cherries with umbels subtended by four non-showy, small involucre bracts; (3) the big-bracted dogwoods with heads subtended by four (rarely five or six) petaloid and large involucre bracts (except *C. disciflora* which lost expansion and petaloidy of bracts); and (4) the dwarf dogwoods, or bunchberries, which are perennial, rhizomatous herbs producing minute, compound dichasia, subtended by four enlarged petaloid bracts.

***Arctocrania* (Endlicher 1839) Reichenbach 1841: 143 [Z-Y. Du, Q-Y. Xiang, P. S. Soltis, and D. E. Soltis], converted clade name**

Registration Number: 833.

Definition: The smallest crown clade containing *Cornus wardiana* Rushforth and Wahlsteen 2021, *C. canadensis* Linnaeus 1753, and *C. suecica* Linnaeus 1753.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Arctocrania* comprises four currently known species (*Cornus wardiana*, *C. canadensis*, *C. suecica*, and *C. unalaschkensis* Ledebour) and their hybrids, occurring disjunctly in Arctic-Sino-Himalayan regions (Wahlsteen *et al.* 2020).

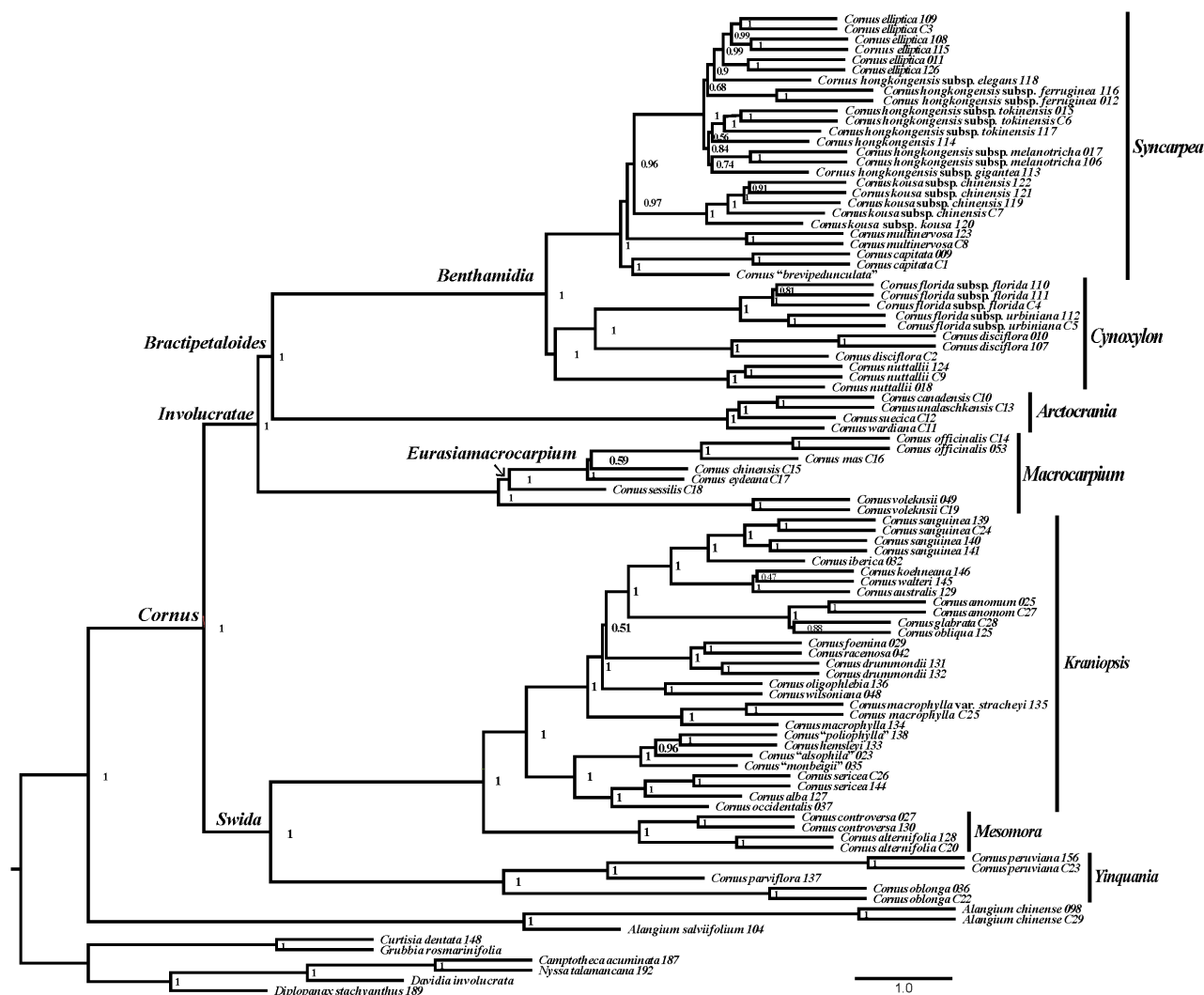


FIGURE 1. Coalescent species tree of *Cornus* inferred from gene trees of Angiosperms353 data (modified from Fig. 1 of Du *et al.* 2023). Local posterior probabilities are annotated at the nodes. The names of 13 crown clades established in this article are indicated.

Diagnostic Apomorphies: Rhizomatous perennial herbs; inflorescences minute tetra-dichasia subtended by four petaloid bracts (Xiang and Boufford 2005; Murrell and Poindexter 2016).

Comments: The dwarf dogwoods have usually been treated as subg. *Arctocrania* Endlicher ex Reichenbach within *Cornus* (e.g., Ferguson 1966; Eyde 1988; Murrell 1993, 1994; Xiang and Boufford 2005; Murrell and Poindexter 2016). The name *Arctocrania* has been consistently used for this group at a subgeneric rank in modern works, plus once at the generic (Nakai 1909) and sectional ranks (Wangerin 1910). The alternative synonym of the clade is *Chamaepericlymenum* Hill, which is the valid name when it is treated as a separate genus (e.g., Hutchinson 1942; Pojarkova 1950). We have selected *Arctocrania* over *Chamaepericlymenum* because it is the name used for the dwarf dogwoods when treated as a subgroup of *Cornus*. Although the name *Chamaepericlymenum* appears to be more frequent than *Arctocrania* in Google Scholar, this is partly due to the citation of *Chamaepericlymenum* as a synonym of *Cornus* and subgen. *Arctocrania* and partly due to its occasional usage for the species name of the herbaceous species. Moreover, the etymology of *Arctocrania*, reflecting its primarily arctic distribution, is more appropriate for this clade. In contrast, *Chamaepericlymenum* means low-growing climbing plant (In Greek, *chamae* for low-growing or humble and *periclymenum* for climbing plant), which is not applicable to species of this clade, the members of which are rhizomatous perennials that do not climb. In addition, *Chamaepericlymenum* is a long word difficult to pronounce, hindering communication by users. For all these reasons, the widely used subgenus name *Arctocrania* is adopted here for the clade.

***Benthamidia* É. Spach 1839 (8): 106 [Z.-Y. Du, Q.-Y. Xiang, P. S. Soltis, and D. E. Soltis], converted clade name**

Registration Number: 836.

Definition: The smallest crown clade containing *Cornus nuttallii* J. J. Audubon 1838, *C. disciflora* Mociño and Sessé 1830, *C. florida* Linnaeus 1753, and *C. kousa* H. Bürger ex Hance 1872.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Benthamidia* comprises approximately nine species and 11 subspecies, occurring in eastern Asia and North America (Du *et al.* 2024).

Diagnostic Apomorphies: Inflorescence has flowers in a head subtended by four involucre bracts that are large and petaloid at anthesis (except in the Mexican *C. disciflora*, which develops four involucre bracts that fall off before they expand and become petaloid); fruits simple or compound, usually red (Xiang and Boufford 2005; Murrell and Poindexter 2016).

Comments: The big-bracted dogwoods have sometimes been treated as a separate genus, named as *Benthamidia* Spach (1839) (Hara 1948), *Benthamia* Lindley *sensu* Nakai (1909), or *Cynoxylon* Raf. (Pojarkova 1950). However, the name *Benthamidia* is the accepted valid name for this clade while *Benthamia* is homonym of an orchid genus. *Cynoxylon* has not been consistently used for this clade. It is more commonly used for the North American subclade at the subgeneric rank (see below). Thus, the big-bracted clade is named *Benthamidia*.

***Cynoxylon* (Rafinesque) Rafinesque 1838: 59 [Z.-Y. Du, Q.-Y. Xiang, P. S. Soltis, and D. E. Soltis], converted clade name**

Registration Number: 837.

Definition: The smallest crown clade containing *Cornus nuttallii* J. J. Audubon 1838 and *C. florida* Linnaeus 1753.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Cynoxylon*, which is nested within *Benthamidia*, comprises three species (*C. nuttallii*, *C. disciflora* Mociño and Sessé ex DC., and *C. florida*) from North America (Murrell and Poindexter 2016). *Cornus florida* has two subspecies.

Diagnosis: Fruits simple (distinct drupes) in clusters developed from head inflorescences. These features are likely plesiomorphies in the *Benthamidia* clade (Murrell and Poindexter 2016).

Comments: The North American species of *Benthamidia* were sometimes treated as the genus *Cynoxylon* Raf. (Rafinesque 1838; Hutchinson 1942) or more commonly as subg. *Cynoxylon* (Raf.) Raf. (1838) (Murrell and Poindexter 2016; Xiang *et al.* 2006) or sect. *Cynoxylon* (Raf.) Hara (Hara 1948) within *Cornus*. The name subg. *Apocarpea* Nakai (1909) also has been proposed for this clade, but it was a synonym of subg. *Cynoxylon* and has not been used subsequently. The name *Cynoxylon* is selected for the clade.

In the plastid gene tree (Figure 3 of Du *et al.* 2023), the clade *Cynoxylon* is paraphyletic with clade *Syncarpea* nested within and *C. nuttallii* being sister to the remainder of *Benthamidia* clade. This relationship is likely a result of differential lineage sorting of dimorphic ancestral chloroplast genomes of the *Benthamidia* clade (e.g., some individuals/populations had an A-type plastid genome while others had a B-type plastid genome). During speciation, *C. nuttallii* happened to fix one of the two plastome types (i.e., B-type) while the ancestors of the *Syncarpea* clade and the *florida-disciflora* clade fixed the other type (i.e., A-type). We believe that the nuclear phylogeny based on many loci is likely correct. However, if *Cynoxylon* is a synonym of *Benthamidia*, *Benthamidia* should have precedence.

***Syncarpea* T. Nakai 1909 (23): 41 [Z.-Y. Du, Q.-Y. Xiang, P. S. Soltis, and D. E. Soltis], converted clade name**

Registration Number: 838.

Definition: The smallest crown clade containing *Cornus capitata* N. Wallich 1820 and *C. kousa* H. Bürger ex Hance 1872.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Syncarpea* comprises approximately 6 species and 9 subspecies in eastern Asia (Du *et al.* 2024).

Diagnostic Apomorphies: Fruits compound (multiple) (Xiang and Boufford 2005).

Comments: The Asian species of big-bracted dogwoods have been treated as the genus *Dendrobenthamia* Hutch. (Hutchinson 1942) or subgenus *Syncarpea* (Nakai) Xiang (Nakai 1909; Xiang 1987; Xiang and Boufford 2005; Murrell and Poindexter 2016) or subgenus *Benthamia* Benth. & Hook. ex Schneider (Wangerin 1910) or a section *Cephalocrania* within *Benthamidia* (Hara 1948). The widely used taxonomic treatments of dogwoods retain the broad sense of *Cornus* defined by Linnaeus and recognize subgenera within it (e.g., Wangerin 1910; Ferguson 1966; Eyde 1987, 1988; Xiang 1987; Xiang and Boufford 2005; Xiang *et al.* 2006; Murrell and Poindexter 2016). Well-known species of the group are much more frequently named under *Cornus* than under *Dendrobenthamia* (e.g., "*Cornus capitata*" vs. "*Dendrobenthamia capitata*" and "*Cornus kousa*" vs. "*Dendrobenthamia kousa*") according to Google Scholar. *Syncarpea* has been known as a subgenus within *Cornus* for the Asian big-bracted dogwoods for more than three decades (Xiang 1987). The word *Syncarpea* refers to the apomorphic compound fruit of the clade. This name also makes better sense than *Dendrobenthamia*, which means “tree *Benthamia*”, while *Benthamia* is an orchid genus named after the same person. For these reasons, we prefer *Syncarpea* over *Dendrobenthamia* for the clade name.

***Bractipetaloides* Z-Y. Du, Q-Y. Xiang, P. S. Soltis & D. E. Soltis, new clade name**

Registration Number: 834.

Definition: The smallest crown clade containing *Cornus canadensis* Linnaeus 1753 and *C. florida* Linnaeus 1753.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Bractipetaloides* comprises approximately 13 species and 11 subspecies, occurring in eastern Asia, North America, and circumboreal regions (Wahlsteen *et al.* 2020; Du *et al.* 2024).

Diagnostic Apomorphies: Involucral bracts that are expanded and petaloid (Xiang and Boufford 2005; Murrell and Poindexter 2016).

Comments: Inflorescences of the dwarf dogwoods and big-bracted dogwoods within this clade are subtended by four or six expanded, showy bracts, except in *C. disciflora*, which lost the feature and exhibits early deciduousness of the bracts before expansion. There is no preexisting name for this clade. Therefore, a new name is established for the clade, *Bractipetaloides*, which refers to the petaloid bracts that are diagnostic for this clade. This name is a revision from “*Bractishowy*”, proposed in Du *et al.* (2023), for better expression of the apomorphic bract feature and for the Latinized form. The study of *Cornales* by Thomas *et al.* (2021) using the same Angiosperm353 data as Du *et al.* (2023) showed that the dwarf dogwood clade (*Arctocrania*, which includes the species *C. canadensis* used as a specifier in the definition of *Bractipetaloides*) was sister to the rest of the genus. If this relationship is correct, the *Bractipetaloides* clade defined here would be equivalent to that of *Cornus*. However, Du *et al.* (2023) found that the sequence alignments in Thomas *et al.* (2021) were not optimal and inaccurate, containing unnecessarily long insertions in some samples of the dwarf dogwood clade (see details in Du *et al.* 2023), which led to the placement of the dwarf dogwoods in Thomas *et al.* (2021).

***Macrocarpium* (Spach) Nakai 1909 (23): 38 [Z-Y. Du, Q-Y. Xiang, P. S. Soltis, and D. E. Soltis], converted clade name**

Registration Number: 831.

Definition: The smallest crown clade containing *Cornus volkensis* H. Harms 1895, *C. sessilis* J. Torrey 1855, and *C. mas* Linnaeus 1753.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Macrocarpium* comprises the six cornelian cherry species, occurring in eastern Africa, eastern Asia, southeastern Europe, and western North America (Xiang *et al.* 2005).

Diagnostic Apomorphies: Flowers yellow, open before leaf emergence; involucre bracts non-petaloid, non-expanded, and herbaceous; inflorescence an umbel; fruit stone walls with scattered cavities (Xiang *et al.* 2005; Xiang and Boufford 2005; Murrell and Poindexter 2016).

Comments: The cornelian cherries were once segregated as the genus *Macrocarpium* (Spach) Nakai, or as two genera *Macrocarpium* and *Afrocrania* Hutchinson, or classified into two subgenera (subg. *Afrocrania* Harms, including only the African species, and subg. *Cornus* = subg. *Macrocarpium*, including the remaining species) (Wangerin 1910; Ferguson 1966), or three subgenera (subg. *Sinocornus* Xiang, subg. *Afrocrania*, and subg. *Cornus*) (Xiang 1987) within *Cornus*. The name *Macrocarpium* was initially used for all the cornelian cherries at the sectional rank by Spach (1839). The name reflects the larger simple fruits of the cornelian cherries in *Cornus*. Therefore, *Macrocarpium* is converted to the clade name.

***Eurasiamacrocarpium* Z-Y. Du, Q-Y. Xiang, P. S. Soltis, and D. E. Soltis, new clade name**

Registration Number: 832.

Definition: The smallest crown clade containing *Cornus eydeana* Q. Y. Xiang and Y. M. Shui 2003, *C. chinensis* W. Wangerin 1908, *C. mas* Linnaeus 1753, and *C. officinalis* P. Siebold and J. G. Zuccarini 1839.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Eurasiamacrocarpium* comprises four Eurasian species (*C. eydeana*, *C. chinensis*, *C. mas*, and *C. officinalis*) of the cornelian cherry clade *Macrocarpium* (Du *et al.* 2023).

Diagnosis: Chromosome number $x = 9$; no apparent morphological apomorphies, but the clade is strongly supported by molecular data (Du *et al.* 2023).

Comments: The Eurasian clade contains *C. eydeana*, *C. chinensis*, and *C. officinalis* from eastern Asia and *C. mas* from Europe. The newly established clade name *Eurasiamacrocarpium* reflects the geographic range of the Eurasian clade of cornelian cherries. The other two species of the cornelian cherry clade *Macrocarpium* occur in western North America (*C. sessilis* Torr. ex Durand) and Africa (*C. volkensii* Harms). The name *Eurasiamacrocarpium* is a revision from “*Eurasiancherry*”, proposed in Du *et al.* (2023) for this clade to reflect its relationship within the *Macrocarpium* clade and eliminate confusion with the *Prunus* cherries.

***Involucratae* de Candolle 1830 (4): 273 [Z-Y. Du, Q-Y. Xiang, P. S. Soltis, and D. E. Soltis], converted clade name**

Registration Number: 830.

Definition: The smallest crown clade containing *Cornus mas* Linnaeus 1753, *C. canadensis* Linnaeus 1753, and *C. florida* Linnaeus 1753.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Involucratae* comprises approximately 19 species and 11 subspecies occurring in the Old and New World (Xiang *et al.* 2006; Wahlsteen *et al.* 2020; Du *et al.* 2023, 2024). It includes all species in the *Benthamidia* clade, *Arctocrania* clade, and *Macrocarpium* clade.

Diagnostic Apomorphies: Inflorescence not expanded by elongation of branches, condensed as head, umbel, or minute dichasia subtended by four, rarely five or six involucre bracts; tenuinucellate ovules (Xiang and Boufford 2005; Murrell and Poindexter 2016).

Comments: This clade consists of three subclades, each with distinct morphological characters, but all have involucre or involucre-like bracts. The developmental origin of bracts within the inflorescence meristem in the *Arctocrania* clade (dwarf dogwoods) suggests that they are not truly involucre, differing from those in the *Benthamidia* (big-bracted dogwoods) and *Macrocarpium* (cornelian cherries) clades that are truly involucre and originated peripheral to the inflorescence meristem (Feng *et al.* 2011, 2012). The name *Involucratae* was initially used to classify species from these three subclades into a section by de Candolle (1830). This literature was missed by Du *et al.* (2023), who constructed a new name “*Involucry*” for the clade. In the study of *Cornales* by Thomas *et al.* (2021) using the same Angiosperm353 data as Du *et al.* (2023), the dwarf dogwood clade *Arctocrania* was shown to be sister to the rest of the genus, leading to possibility of the name *Involucratae* being a synonym of *Cornus*. This possibility is unlikely due to the aforementioned reasons provided under *Bractipetaloides*. However, if it were to occur, *Cornus* should have precedence.

***Swida* F. von Berchtold and P. M. Opiz. 1838 (2): 174 [Z.-Y. Du, Q.-Y. Xiang, P. S. Soltis, and D. E. Soltis], converted clade name**

Registration Number: 826.

Definition: The smallest crown clade containing *Cornus oblonga* N. Wallich 1820, *C. alternifolia* Linnaeus 1782, *C. sanguinea* Linnaeus 1753, and *C. alba* Linnaeus 1767.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Swida* comprises approximately 38 species, occurring mainly in Asia, Europe, and North America, with one species extending to northern Central America and one in northern Andes of South America extending to southern Central America. Species diversity is centered in eastern Asia and eastern North America (Lindelof *et al.* 2020). The clade *Swida* contains all species of clade *Kraniopsis*, clade *Mesomora*, and clade *Yinquania* defined below.

Diagnosis: Flowers creamy white; inflorescences complex, branched and elongate, flat-, round-, or pyramid-topped; fruits white, blue, or black (Xiang and Boufford 2005; Murrell and Poindexter 2016). These features are likely plesiomorphic.

Comments: Species of the clade produce elongate inflorescences with rudimentary, usually early-deciduous bracts at the base of or on the inflorescence branches. The group was sometimes recognized as the genus *Swida* Opiz (von Berchtold and Opiz 1838; Poindexter *et al.* 2020) or the genus *Thelycrania* Fourreau or as the section *Thelycrania* Dumortier or the subg. *Thelycrania* Endlicher ex Schneider within *Cornus* (Wangerin 1910; Ferguson 1966). The name *Swida* appears much better known than *Thelycrania* due to being the valid genus name when it is separated out from *Cornus*. Hence, the preexisting name *Swida* is converted into the clade name.

***Kraniopsis* C. S. Rafinesque 1838: 58 [Z.-Y. Du, Q.-Y. Xiang, P. S. Soltis, and D. E. Soltis], converted clade name.**

Registration Number: 827.

Definition: The smallest crown clade containing *Cornus alba* Linnaeus 1767, *C. sanguinea* Linnaeus 1753, *C. macrophylla* N. Wallich 1820, *C. amomum* P. Miller 1768, *C. glabrata* G. Bentham 1844, *C. hemsleyi* C. K. Schneider and W. Wangerin 1909, *C. racemosa* Lamarek 1786, and *C. wilsoniana* W. Wangerin 1908.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Kraniopsis* comprises approximately 33 species, occurring in Asia, Europe, and North America, with one Mexican species extending to northern Central America. Species diversity is centered in eastern Asia and eastern North America (Xiang and Boufford 2005; Xiang *et al.* 2006; Murrell and Poindexter 2016; Lindelof *et al.* 2020; lists of species may be found in the cited references).

Diagnosis: Leaves opposite; endocarp not pitted. These diagnostic features are likely plesiomorphies of the clade (Xiang and Boufford 2005; Murrell and Poindexter 2016).

Comments: The *Kraniopsis* clade was previously widely recognized as subgenus *Kraniopsis* within *Cornus* (Ferguson 1966; Murrell 1993; Xiang and Boufford 2005; Xiang *et al.* 2006; Murrell and Poindexter 2016). It is better known than the alternative synonym *Thelycrania*, which was sometimes used for more inclusive clades (see Comments under *Swida*, above). Here the accepted subgenus name *Kraniopsis* is adopted for this clade.

***Mesomora* C. S. Rafinesque 1838: 58 [Z.-Y. Du, Q.-Y. Xiang, P. S. Soltis, and D. E. Soltis], converted clade name**

Registration Number: 828.

Definition: The smallest crown clade containing *Cornus alternifolia* Linnaeus 1782 and *C. controversa* Hemsley 1909.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Mesomora* comprises two species disjunctly occurring in eastern Asia (*C. controversa*) and eastern North America (*C. alternifolia*) (Lindelof *et al.* 2020).

Diagnostic Apomorphies: Leaves alternate, endocarp pitted at the apex, and chromosome number $x = 10$ (Xiang and Boufford 2005; Murrell and Poindexter 2016).

Comments: The *Mesomora* clade has been commonly recognized as subgenus *Mesomora* within *Cornus* (Ferguson 1966; Eyde 1988; Murrell 1993; Xiang and Boufford 2005; Xiang *et al.* 2006; Murrell and Poindexter 2016; Lindelof *et al.* 2020). The clade was once classified as a section *Bothrocaryum* Koehne. within subgenus *Thelycrania* of *Cornus* (Wangerin 1910) or as the separate genus *Bothrocaryum* (Koehne) Pojarkova. The most widely accepted taxonomic treatments of dogwoods retain the broad Linnaean concept of *Cornus*, within which these two alternate-leaved species were treated as subgenus *Mesomora*. Although the name *Bothrocaryum* appears to be more frequent than *Mesomora* according to Google Scholar, it is partly due to citation of the name as synonyms of *Cornus* and subgenus *Mesomora* in literature, and partly due to its usage in the species names in some cases where authors treated the clade as a genus. The two alternate-leaved species are mainly known as species of *Cornus* rather than species of *Bothrocaryum*. A search on the exact phrase "*Cornus controversa*" returns 4080 results in Google Scholar, while the phrase "*Bothrocaryum controversum*" returns 214 results. Similarly, the exact phrase "*Cornus alternifolia*" returns 4220 results in Google Scholar while "*Bothrocaryum alternifolium*" returns 10 results. Therefore, the widely known subgenus name *Mesomora* is adopted for the clade.

***Yinquania* Z. Y. Zhu 1984 (4): 121 [Z.-Y. Du, Q.-Y. Xiang, P. S. Soltis, and D. E. Soltis], converted clade name**

Registration Number: 829.

Definition: The smallest crown clade containing *Cornus oblonga* N. Wallich 1820 (including *Yinquania muchuanensis* Z. Y. Zhu 1984), *C. peruviana* J. F. Macbride 1929, and *C. parviflora* S. S. Chien 1931.

Reference Phylogeny: Figure 1 in Du *et al.* (2023); see also Figure 1 in this article.

Composition: The clade *Yinquania* comprises 3 or 4 currently known species, occurring in eastern Asia (*C. oblonga* including *Yinquania muchuanensis* and *C. parviflora*) and Central and South America (*C. peruviana*) (Du *et al.* 2023).

Diagnosis: Evergreen trees with occasionally subopposite leaves.

Comments: The *Yinquania* clade was previously recognized as subgenus *Yinquania* (Z. Y. Zhu) Q. Y. Xiang, and Boufford (Murrell 1993; Xiang and Boufford 2005; Lindelof *et al.* 2020) or genus *Yinquania* (Zhu 1984). No apparent morphological synapomorphies uniting the clade have been identified. The clade is strongly supported by molecular data (Du *et al.* 2023). The only approximate alternative synonym is subsection *Oblongifoliae* Wangerin 1910, which included only *C. oblonga* Wall. The better known and more widely used *Yinquania* is converted to the clade name.

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