

A CONSPECTUS OF ANGIOSPERM SUPERTRIBES

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Abstract. The inconspicuous rank of supertribe is rarely used in botanical classification, being only reserved for large families with high tribal-level diversity. The purpose of the supertribe is to provide further hierarchical resolution within a tribally rich subfamily by allowing clades containing multiple tribal-level taxa to be recognized at rank level. Thus far, this rank has been proposed for six angiosperm families: Asteraceae, Brassicaceae, Poaceae, Rosaceae, Rubiaceae, and Sapindaceae. Here, the rank of supertribe is further extended to the families Araceae, Cactaceae, and Fabaceae, along with new additions in Rubiaceae and Sapindaceae. In the subfamily Aroideae s.l., four well-supported clades are newly recognized as supertribes Arodae, Philodendrodae, Schismatoglottidodae, and Zamioculcadodae. In Cactoideae, the two largest and commonly recognized core clades I and II are validated as supertribes Echinocereodae and Cereodae, respectively. In Papilionoideae, supertribes Dalbergiodae, Galegodae, Genistodae, Myroxylodae, and Phaseolodae are newly validated, corresponding to five commonly recovered supra-tribal clades. In Rubiaceae, five tribal alliances are newly equated to the supertribes Coffeodae, Dialypetalanthodae, Lasianthodae, Mussaendodae, and Urophyllodae. The publication of the two Maloideae supertribes Kerriodae and Pyrodade, originally published improperly, are herein validated. In Sapindoideae, Cupaniodae is newly described while the limits of Paulliniodae are expanded, and its effective publication corrected through typification. Additionally, the tribal name Chesneyeae is newly validated and corrected. This account brings the total number of currently accepted supertribes across the angiosperms to 36. A brief synopsis of all published and accepted supertribal names is provided.

Keywords: infrafamilial classification, suprageneric classification, tribal alliance, Fabaceae, Araceae

Very few plant families are large enough to require an infrafamilial rank of the fourth order. In some rare instances, however, the use of such a rank may be justified when increased phylogenetic resolution is favored within a given subfamily (Robinson, 2004). The supertribe (names ending in “-odae”) is available as an additional rank in the traditional Linnean hierarchy positioned below the subfamily and above tribe (Reveal, 2012). A rather obscure rank in botanical taxonomy, its use is only recommended for large subfamilies with a high enough tribal count to justify additional hierarchical stratification above the tribal level, particularly when the rank of subtribe has already been filled.

Groups of tribes within subfamilies have long been recognized informally by taxonomists in some of the largest families. Morphologically heterogeneous, yet strongly supported clades made up of multiple tribal-level taxa which are consistently recovered and well-supported by molecular analyses are regularly given informal clade names. These groups are sometimes referred to as “tribal alliances,” such as those in Araceae (e.g., Schismatoglottid alliance), Asteraceae (e.g., Heliantheae alliance), and Rubiaceae (e.g., Coffeae alliance). While many authors continue to use informal non-Linnean names, some authors have alternatively begun recognizing these multi-tribal clades more formally at rank level as supertribes. The earliest record of validly published supertribal names were for the Poaceae subfamily Pooideae (Liu, 1980).

Given how underutilized this rank is by plant taxonomists, as compared to their zoological counterparts, it is understandable as to why it has not yet been recognized as an official rank through Art. 4.2 of the *Code* (Turland et al., 2018). Yet even the continued maintenance of its unofficial status as a rank in the *Code* has not stopped plant

taxonomists working on large families from continuously invoking it (Liu, 1980; Macfarlane and Watson, 1982; Watson et al., 1985; Avetisyan, 1990; Robinson, 2004, 2005; Robbrecht and Manen, 2006; Potter et al., 2007; Acevedo-Rodríguez et al., 2017; Soreng et al., 2017; German et al., 2023). Although, in fairness, its usage offers but a slight convenience in the classification of only a few large families and its official recognition in the *Code* would have little bearing on the classification system as a whole. With ever-increasing phylogenetic resolution of generic and tribal relations across the angiosperms, however, there may come a need for further taxonomic stratification of certain groups. Thus, eventual codification of the supertribe under Art. 4 may become increasingly inevitable.

In contrast to most tribes and subtribes, the rank of supertribe does not usually adhere to traditional rules of morphological recognizability—and this is for the better. Groups of multiple tribes, regardless of how strongly supported their monophyly is, may not easily be defined by uniformly shared morphology, nor should they be expected to. In order to give the rank increased flexibility in recognition, supertribes are not generally expected to exhibit any guaranteed (syn)apomorphic traits or otherwise be diagnoseable in the traditional sense. Thus, strong molecular support uniting a clade of multiple tribal-level taxa may be all that is necessary to allow for supertribal designation. Any morphological similarities found among the contained tribes may serve to further the case for their recognition at this rank; however, this is not deemed a prerequisite. Unlike most other ranks, the adoption of the supertribe within a given subfamily may be sought for purely hierarchical grouping purposes, essentially taking the excessive tribal “load” off the subfamily rank by transferring it to the supertribe.

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When recognizing supertribes, the broadest, most inclusive clade is usually chosen in preference over smaller less inclusive nodes to be named at rank level. This allows for an increased number of tribes to be accommodated, leading to more useful higher-order taxonomic groupings. Choosing deeper nodes within a subfamily's backbone allows for tribes to be placed within a more informative hierarchy. Furthermore, supertribes that do not convey any additional taxonomic information are not recognized in this account. This includes those that are monotypic (delimited with a single tribe) or those that encompass all but one or a few tribes in a given subfamily. These all help to minimize the

rank's excessive and unnecessary proliferation.

Thus far in the literature, there have been a total of 32 supertribal-level names published for six families (Appendix I). Of those previously published, 28 were validly published, three invalidly so, and one published without typification. In this account, 17 of the previously published names are accepted and an additional 19 are newly proposed for five families, while the publication of two others are corrected and the tribal limits of some updated. A total of 36 supertribes are recognized as accepted for nine families (Appendix II).

ARACEAE

Of the now seven accepted subfamilies, Aroideae is both the largest and most morphologically complex (Zhao et al., 2022; Haigh et al., 2023). This complexity is reflected in the 26 tribes that have been recognized thus far. Here, four commonly recovered and informally recognized supra-tribal clades are formalized at supertribal level. These clades correspond to major groupings of tribes that were all once recognized as separate subfamilies until eventually being subsumed under the now expanded Aroideae s.l. concept that is currently accepted. Under the proposed classification here, only four tribes remain unplaced to supertribal level, all of which are monotypic. While the tribes and supertribes themselves are well-supported as monophyletic in molecular analyses, their arrangement along the phylogenetic backbone of the subfamily is still unresolved as placement of the isolated monotypic tribes remains disputed (Cusimano et al., 2011; Nauheimer et al., 2012; Zhao et al., 2022).

1. Arodae Ezedin, *supertrib. nov.*, based on Aroideae Arn., Botany: 136. 1832. [subfam. Aroideae]
TYPE: *Arum* L., Sp. Pl. 966. 1753.

Included tribes: Alocasieae A.Hay; Areae R. Br. ex Duby; Arisaemateae Nakai; Arisareae Dumort.; Arophyteae A. Lemee ex Bogner; Caladieae Schott; Colocasieae Brongn.; Peltandreae Engl.; Pistieae Lecoq & Juill.; Protareae Engl.; Thomsonieae Blume; and Typhonodorea Engl.

This clade generally corresponds to the old core Aroideae sensu Keating (2004). Informally known as the *Dracunculus* clade in Cusimano et al. (2011: clade 37) and likewise corresponding to clade 47 in Fig. 3 of Nauheimer et al. (2012). A brief morphological characterization of this clade is given by Cusimano et al. (2011). The supertribe can be divided into three further subunits that have been informally named the *Amorphophallus*, *Colletogyne*, and *Pistia* clades by Cusimano et al. (2011), which respectively correspond to the clades numbered 48, 62, and 68 in Fig. 3 of Nauheimer et al. (2012). These nodes are not chosen to be named at rank level due to not being the most inclusive nodal grouping of tribes available, as well as not containing any morphologically significant features when compared to the broader *Dracunculus* clade (Nauheimer et al., 2012).

The genus *Typhonodorum* Schott occupies an isolated position in relation to *Peltandra* Raf. and is thus here recognized in its own tribe, for which a name is already available. The tribe Alocasieae was recently recognized to incorporate the four closely related genera *Alocasia* (Schott) G. Don, *Englerarum* Nauheimer & P.C.Boyce, *Leucocasia* Schott, and the recently described *Vietnamocasia* N.S. Lý, S.Y. Wong, & P.C. Boyce which form a decently- to well-supported clade (Lý et al., 2017; Baker et al., 2022).

2. Philodendrodae Ezedin, *supertrib. nov.*, based on Philodendroideae Engl., Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur. 39: 146. 1876. [subfam. Aroideae]
TYPE: *Philodendron* Schott, Wiener Z. Kunst 3: 780. 1829.

Included tribes: Aglaonemateae Engl.; Culcasieae Engl.; Nephthytideae Engl.; Philodendreae Schott; Spathicarpeae Schott; and Zantedeschieae Engl.

This clade roughly corresponds with the now defunct subfamily Philodendroideae sensu Keating (2004) upon the exclusion of four tribes: Anubiadeae, Montrichardieae, Stylochaetoneae, Zamioculcadeae. In molecular phylogenies, it is informally known as the *Zantedeschia* clade in Cusimano et al. (2011: clade 32) and likewise corresponds to clade 109 in Fig. 3 of Nauheimer et al. (2012). Support for this clade appears to range from good to strong, but interestingly appears to be non-monophyletic in the RAxML-ASTRAL trees in Figs. 1 and 2 of Zhao et al. (2022), with Spathicarpeae appearing to disassociate from the rest; although, the group appears monophyletic again in their IQTREE tree results in Appendix S6. The genera *Anubias* Schott and *Montrichardia* Cureg., both placed in their own monotypic tribes, while initially included by Keating (2004) in his concept of Philodendreae, appear to resolve in isolated positions outside it with strong support.

3. Schismatoglottidodae Ezedin, *supertrib. nov.*, based on Schismatoglottidoideae R.C. Keating, Ann. Missouri Bot. Gard. 91: 494. 2004. [subfam. Aroideae]
TYPE: *Schismatoglottis* Zoll. & Moritzzi in A. Moritzzi, Syst. Verz. Java: 83. 1846.

Included tribes: Cryptocoryneae Blume; Philonotieae S.Y. Wong & P.C. Boyce; and Schismatoglottideae Nakai
Informally known as the rheophytes clade or the

Schismatoglottid alliance and corresponds to the former subfamily Schismatoglottidoideae sensu Keating (2004). It is well-supported in molecular analyses in Cusimano et al. (2011: clade 28), in Fig. 3 of Nauheimer et al. (2012: clade 96), and in Baker et al. (2022). The clade is best known for exhibiting high levels of rheophytism, as its members are often found growing on rocks in slow to fast flowing streams and rivers, either in partial or total submergence. Other than the Neotropical *Philonotium* Schott, the entire supertribe is restricted to S and SE Asia, where many species are narrow endemics limited to specific rivers or drainage basins (Yeng, 2013).

4. Zamioculcadodae Ezedin, *supertrib. nov.*, based on Zamioculcadoideae, Bogner & Hesse, *Aroideana* 28: 13. 2005. [subfam. Aroideae]

The rank of supertribe was first introduced into Asteraceae for the subfamily Asteroideae by Robinson (2004). Three were recognized in his account: Asterodae, Senecionodae, and Helianthodae. The first two are closely related and may even be reciprocal sisters, although there are prominent topological conflicts surrounding that clade requiring further investigation (Watson et al., 2020). Morphologically, Asterodae and Senecionodae are differentiated by the presence of raphides in the achene walls (Robinson, 2004). Due to currently containing only a single tribe (Senecioneae), however, the monotypic supertribe Senecionodae is not recognized here, as it offers no additional taxonomic information. Although, it could still be recognized if either the delimitation of Asterodae changes or if the tribe Senecioneae itself were to be reclassified as a supertribe and its current subtribes raised to tribal level.

5. Asterodae H. Rob., *Phytologia* 87(2): 73. 2005. [subfam. Asteroideae]

TYPE: *Aster* L., Sp. Pl. 872. 1753.

Includes tribes: Calenduleae Cass.; Anthemideae Cass.; Astereae Cass.; and Gnaphalieae Lecoq & Juill.

Informally known as the Astereae alliance. The delimitation of Asterodae remains unchanged from Robinson (2004) as it was originally defined with the four tribes. Phylogenetically, there appears to be a significant

conflict in the topology between these four tribes, primarily with respect to the placement of Anthemideae, most likely due to reticulate evolution following ancient hybridization (Watson et al., 2020). The supertribe was initially designated in Robinson (2004), but was not validly published until a year later in Robinson (2005).

TYPE: *Zamioculcas* Schott, Syn. Aroid.: 71. 1856.

Included tribes: Stylochaetoneae Schott and Zamioculcadeae Schott ex Engl.

This supertribe encompasses the expanded concept of the now defunct subfamily Zamioculcadoideae, with the two tribes recently having been subsumed under a further expanded Aroideae s.l. by Haigh et al. (2023). In phylogenetic studies, this clade is alternatively referred to as the *Stylochaeton* clade, corresponding to clade 25 of Cusimano et al. (2011) and clade 39 of Nauheimer et al. (2012). The clade is well-supported as sister to the remainder of the Aroideae, the latter now more clearly defined by unisexual flowers (Zhao et al., 2022). Morphologically, this supertribe may be diagnosed primarily via pollen, which differs from the remainder of Aroideae s.l. (Hesse et al., 2001).

ASTERACEAE

6. Helianthodae H. Rob., *Phytologia* 86: 118. 2004. [subfam. Asteroideae]

TYPE: *Helianthus* L., Sp. Pl. 904. 1753.

Included tribes: Athroismeae Panero; Bahieae B.G. Baldwin; Chaenactideae B.G. Baldwin; Coreopsidae Lindl.; Eupatorieae Cass.; Feddeae Pruski, Herrera, Anderb., & Franc.-Ort.; Helenieae Lindl.; Heliantheae Cass.; Inuleae Cass.; Madieae Jeps.; Millerieae Lindl.; Neurolaeneae Rydb.; Perityleae B.G. Baldwin; Polymnieae Panero; and Tageteae Cass.

Informally known as the Heliantheae alliance. Helianthodae was originally delimited by Robinson (2004) to include seven tribes: Athroismeae, Coreopsidae, Eupatorieae, Helenieae, Heliantheae, Inuleae, and Tageteae. Here the supertribe is expanded to encompass the entire Heliantheae alliance, comprising 15 tribes which form a well-supported clade (Mandel et al., 2019). The linear sequence of Susanna et al. (2020) shows the tribes Athroismeae and Inuleae excluded from the Heliantheae alliance.

BRASSICACEAE

This family was the second after Poaceae to receive supertribes, with three supertribal names being published by Avetisyan (1990). However, due to the family's complex taxonomic history and unresolved phylogenetic relations, a supra-tribal classification was not capable of being properly implemented by taxonomists. Until very recently, this family had been without a stable internal classification with tribal boundaries experiencing regular disruption. Due to this, a reliable suprageneric classification system for the family had been unavailable until the recent advances

made towards increased resolution of the family's internal relations (Guo et al., 2017; Nikolov et al., 2019; Hendriks et al., 2023). Despite lingering uncertainties, supra-tribal groups had nonetheless started being hypothesized since early molecular work in the family (Beilstein et al., 2008).

This recent taxonomic effort has now culminated in the recognition of two subfamilies, Aethionemoideae and Brassicoideae: the former with only *Aethionema* R. Br. and the latter containing the remainder of the family, classified into 58 tribes. Following the results of a recent family-wide

phylogenomic study, a revised supertribal classification was proposed for the latter by German et al. (2023), with the authors proposing five such taxa. Their classification is mirrored here. In the currently proposed scheme, all but six tribes in the Brassicoideae are assigned to a supertribe. It should be noted that a subtribal classification has yet to be implemented in the subfamily, despite some tribes appearing large enough to potentially accommodate them.

7. Arabodae D.A. German et al., *PhytoKeys* 220: 129. 2023. [subfam. Brassicoideae]

TYPE: *Arabis* L., Sp. Pl. 664. 1753.

Included tribes: Arabideae DC.; Alysseae DC.; Asperuginoideae Al-Shehbaz et al.; and Stevenieae Al-Shehbaz, D.A. German & M. Koch

In recent phylogenies known as Lineage IV. German et al. (2023) note that the limits of the supertribe are not yet stable due to discordance in the positions of all tribes except Arabideae.

8. Brassicodae V.E. Avet., *Biol. Zhurn. Armenii* 43: 602. 1990. (*Brassicidiniae*) [subfam. Brassicoideae]

TYPE: *Brassica* L., Sp. Pl. 666. 1753.

Included tribes: Aphragmeae D.A. German & Al-Shehbaz; Bivonaeeae M. Koch & Warwick; Brassiceae DC.; Calepineae Horan.; Coluteocarpeae V.I. Dorf; Conringieae D.A. German & Al-Shehbaz; Eutremeae Al-Shehbaz, Beilstein, & E.A. Kellogg; Fouraeae Al-Shehbaz, M. Koch, R. Karl, & D.A. German; Isatideae DC.; Kernereae Al-Shehbaz, Warwick, Mumm., & M. Koch; Plagiolobeae Khosravi & Eslami-Farouji; Schrenkielleae Al-Shehbaz et al.; Sisymbrieae DC.; Thelypodieae Prantl; and Thlaspieae DC.

In recent phylogenies known as Lineage II. The tribe Cochlearieae remains unplaced to supertribe due to discordant relations seen in nuclear versus plastid data (Hendriks et al., 2023).

9. Camelinodae D.A. German et al., *PhytoKeys* 220: 130. 2023. [subfam. Brassicoideae]

TYPE: *Camelina* Crantz, *Stirp. Austr. Fasc. 1*: 18. 1762.

The cactus family has no prior history of supertribal classification. The largest subfamily, Cactoideae, is commonly divided into three major groups: the tribe Cacteae and the informally named Cactoideae I and II clades (Guerrero et al., 2019). The latter two clades are further subdivided into two(–three) and three(–six) tribal-level clades, respectively. In addition to these three major clades, the tribes Copiapoeae, Fraileae, Lymanbensoniae, and sometimes Rhipsalideae have variously been recovered forming part of the grade leading up to the core and thus remain unplaced to supertribe (Guerrero et al., 2019; Romeiro-Brito et al., 2022). Both supertribes recognized here have decent support, despite tribal limits within them remaining partially unresolved. Additionally, the family's overall phylogenetic backbone at the subfamily and tribal level is only still moderately resolved.

Included tribes: Alyssopsidae Al-Shehbaz, Warwick, Mumm., & M. Koch; Arabidopsidae Al-Shehbaz et al.; Boechereae Al-Shehbaz, Beilstein, & E.A. Kellogg; Camelineae DC.; Cardamineae Dumort.; Crucihimalayae D.A. German & Al-Shehbaz; Descurainieae Al-Shehbaz, Beilstein, & E.A. Kellogg; Erysimeae Dumort.; Halimolobeae Al-Shehbaz, Beilstein, & E.A. Kellogg; Hemilophieae Al-Shehbaz et al.; Lepidieae DC.; Malcolmieae Al-Shehbaz & Warwick; Microlepidieae Al-Shehbaz, Warwick, Mumm., & M. Koch; Oreophytoneae Al-Shehbaz, Warwick, Mumm., & M. Koch; Physarieae B.L. Rob.; Smelowskieae Al-Shehbaz, Beilstein, & E.A. Kellogg; Turritideae Buchenau; and Yinshanieae Al-Shehbaz, Warwick, Mumm., & M. Koch

In recent phylogenies known as Lineage I. Two genera remain unplaced to tribal level here (German et al., 2023).

10. Heliophilodae D.A. German et al., *PhytoKeys* 220: 131. 2023. [subfam. Brassicoideae]

TYPE: *Heliophila* Burm.f. ex L., Sp. Pl. ed. 2.: 926. 1763.

Included tribes: Anastaticae DC.; Asteae Al-Shehbaz, Warwick, Mumm., & M. Koch; Biscutelleae Dumort.; Chamireae Sond.; Cremolobeae R. Br.; Eudemeae Al-Shehbaz, Warwick, Mumm., & M. Koch; Heliophileae DC.; Hilliellae H.L. Chen, T. Deng, J.P. Yue, Al-Shehbaz, & H. Sun; Iberideae Webb & Berthel.; Notothlaspidiae Al-Shehbaz, Warwick, Mumm., & M. Koch; Schizopetaleae R. Br. ex Barnéoud; and Subularieae DC.

In recent phylogenies known as Lineage V. The tribe Scoliaxoneae is now synonymized under Asteae. The limits of this supertribe are not yet stable with the placement of five tribes still disputed (German et al., 2023).

11. Hesperodae D.A. German et al., *PhytoKeys* 220: 132. 2023. [subfam. Brassicoideae]

TYPE: *Hesperis* L., Sp. Pl. 663. 1753.

Included tribes: Anchonieae DC.; Buniadeae DC.; Chorisporeae Ledeb., C.A. Mey., & Bunge; Dontostemoneae Al-Shehbaz & Warwick; Euclidieae DC.; Hesperideae Prantl; and Shehbazieae D.A. German

In recent phylogenies known as Lineage III.

CACTACEAE

12. Cereodae Ezedin, *supertrib. nov.*, based on Cereoideae Drude in C. F. P. von Martius, *Fl. Bras.* 4(2): 193. 1890. [subfam. Cactoideae]

TYPE: *Cereus* Mill., *Gard. Dict. Abr. ed. 4*: s.p. 1754.

Included tribes: Cereae Salm-Dyck and Notocactaeae Buxb.

Informally known as the Cactoideae II or the RNBCT clade. Traditionally, the tribe Rhipsalideae has been included in this group, as several phylogenies have recovered the clade [Rhipsalideae [Notocactaeae + Cereae]] (Korotkova et al., 2010; Hernández-Hernández et al., 2014; Guerrero et al., 2019; Romeiro-Brito et al., 2022). However, whereas the [Notocactaeae + Cereae] clade is often recovered in molecular studies with good support, the support often weakens upon inclusion of the Rhipsalideae (Hernández-Hernández et al., 2011; Baker et al., 2022). In their

512-targeted loci phylogeny of the family, Romeiro-Brito et al. (2022) again recovered Rhipsalideae disassociating from the rest of the Cactoideae II clade. Due to the problematic molecular placement of Rhipsalideae, it is here excluded from the supertribe as a precautionary measure.

It should be noted that the expanded concept of Cereae is recognized here, inclusive of Trichocereae, which is now reduced to subtribal level, essentially covering the entire “BCT” clade. Currently, three dubiously supported subtribes are included within it: Cereinae, Trichocereinae, and Rebutiinae (Romeiro-Brito et al., 2022).

13. *Echinocereodae* Ezedin, *supertrib. nov.* [subfam. Cactoideae]

TYPE: *Echinocereus* Engelm. in F. A. Wislizenus, Mem. Tour N. Mexico: 91. 1848.

Low-growing, scandent, creeping, shrubby, epiphytic, epilithic, or tree-like and columnar. Stems erect, ascending, pendulous, or procumbent, cylindrical or angular, sometimes flattened when epiphytic, ribs (2–)6–10(–30). Spines present (rarely absent), straight to sometimes hooked, hair-like or bristly to stout and harsh, short to very long. Flowers usually subapical or 1 to 2 per areole, (tubular-)campanulate, urceolate, funnellform, salverform, or rarely rotate (when epiphytic), diurnal or nocturnal, tubes short, scales small

As one of the largest and morphologically diverse angiosperm subfamilies, it may at first seem rather surprising that the Leguminosae subfamily Papilionoideae has gone on so long without being assigned a supertribal classification. However, this is likely, in part, due to our poor understanding of supra-tribal groupings and the relations among subfamilies until only recently (Cardoso et al., 2013; LPWG, 2017; Zhao et al., 2021; Choi et al., 2022). Here, five supertribes are newly validated for five commonly referenced and molecularly well-supported groups in the Papilionoideae. Due to issues surrounding the tribal limits within the mirbelioids clade, comprising the paraphyletic sister tribal pair Bossiaceae and Mirbelieae, along with the possibility of a future merger between the two (Barrett et al., 2021), the clade is left without supertribal designation. Recognition of these supra-tribal taxa allows for greater consolidation in the internal hierarchy of the Papilionoideae, where cladistic relations can now be summarized in the following short-hand manner: [Myroxlodae [Swartzieae [Cladrastieae [Exostyleae [“vataireoid” clade [[Dalbergiodae + Genistodae] [Andira clade [Baphieae [Hypocalyptae [[Bossiaceae + Mirbelieae] [Galegodae + Phaseolodae]]]]]]]]]] (Zhao et al., 2021; Choi et al., 2022).

The mimosoid clade, formerly circumscribed as the subfamily Mimosoideae and now known to be deeply embedded within Caesalpinioideae s.l. (LPWG, 2017), is better suited to being entirely limited at tribal level (as Mimoseae) and is therefore not treated at supertribal level here. Although diverse, the deep ladder-like topology of the group’s phylogenetic backbone (Koenen et al., 2020) hinders any meaningful multi-tribal classification. As such, it may be preferable to split the mimosoids into subtribal-level clades, if any at all. Similarly, if the Australian

to prominent and sometimes numerous, stamens few to numerous, sometimes in 1 or 2 series. Fruits (sub)globose to oblong, sometimes berry-like, usually spiny, hairy, and/or scaly, fleshy (rarely dry), with floral remnants persistent or not.

Included tribes: Hylocereae Buxb.; Leptocereae Buxb.; and Pachycereae Buxb.

Informally known as the Cactoideae I or the ACHLP clade. This clade is reported to be well-supported by several studies (Hernández-Hernández et al., 2011; Hernández-Hernández et al., 2014; Baker et al., 2022). The supertribe contains six major tribal-level clades: *Corryocactus*, *Pfeiffera*, [*Austrocactus* + *Eulychnia*], Leptocereae, Hylocereae, and Pachycereae. The first two phylogenetically isolated genera, *Corryocactus* Britton & Rose and *Pfeiffera* Salm-Dyck, are commonly recovered in isolated positions along the basal grade successively sister to the rest of Cactoideae I, leading up to the “PHB” clade (Korotkova et al., 2010; Hernández-Hernández et al., 2011; Hernández-Hernández et al., 2014; Guerrero et al., 2019). However, they were found to be well-supported in a sister clade relationship including *Eulychnia* Phil. in Baker et al. (2022). Further work is needed to assess the tribal placement of these two genera, along with *Austrocactus* Britton & Rose and *Eulychnia*. For now, all four genera remain unplaced to tribal level.

FABACEAE

mirbelioids are to be merged into a single tribe, a subtribal classification may be preferable as a means to preserve any internal divisions.

14. *Dalbergiodae* Ezedin, *supertrib. nov.*, based on Dalbergioideae Burnett, *Outlines Bot.*: 661. 1835. [subfam. Papilionoideae]

TYPE: *Dalbergia* L. f., *Suppl. Pl.*: 52. 1782.

Included tribes: Amorpheae Boriss. and Dalbergieae DC.

Informally known as the dalbergioids. The supertribe includes two tribes that are resolved in a sister relationship with good support (Wojciechowski et al., 2004; Zhao et al., 2021). Previously, the two tribes were united under the suggested name “Dalbergioids s.l.” by Wojciechowski et al. (2004: Fig. 3) and Choi et al. (2022: Fig. 5). Here, the limits of Dalbergieae follow that indicated by Zhao et al. (2021: Fig. 3), which is essentially the sensu lato concept. Although not known by any reliable synapomorphies, according to Lavin et al. (2001), the dalbergioids (including Dipterygeae, now placed in the ADA clade) can be broadly defined by a base chromosome count of $x = 10$, wood with uniseriate stored rays, vegetative growth with glandular punctae, flowers with fused keel petals or staminal filaments, and seeds that do not accumulate nonprotein amino acids.

15. *Galegodae* Ezedin, *supertrib. nov.*, based on Galegoideae Schimp. in E. A. Strasburger, *Lehrb. Bot.*: 480. 1894. [subfam. Papilionoideae]

TYPE: *Galega* Tourn. ex L., *Sp. Pl.* 714. 1753.

Included tribes: Astragaleae Dumort.; Caraganeae Boriss.; Chesneyae Ezedin; Cicereae Alef.; Galegeae Bronn; Glycyrrhizae Rydb.; Hedysareae DC.; Loteae DC.;

Robinieae Hutch.; Sesbanieae Hutch.; Trifolieae Endl.; Viciae DC.; and Wisterieae X.Y. Zhu

Informally known as the Hologalegina clade, comprising tribes that are largely temperate in distribution and herbaceous in habit (Wojciechowski et al., 2000). This supertribe is strongly supported as monophyletic and incorporates four informally named subclades which are not recognized at rank level: the IR-lacking clade, robinoids, vicioids, and hedysaroids (Zhao et al., 2021). The Hologalegina clade is chosen to be represented at supertribal level in preference over the latter four lower nodes, as it incorporates a greater extent of tribes, allowing for a more inclusive classification and deeper stratification of the subfamily.

A correction is made here to the publication of the tribe “Chesneyeae L. Duan, Zhao Y. Chang, & J. Wen,” which is problematic as it was originally published in a Chinese language thesis dissertation by Duan (2015: 76). A copy of the whole Chinese dissertation was then attached as Suppl. Data File 1 in the journal article by Duan et al. (2021), where the authors made a brief reference to the tribal name in the main text of the journal article (on page 6). Yet due to being originally published in a non-serial dissertation work, along with the original Chinese diagnosis provided, the tribal name Chesneyeae is not considered validly published under ICN Art. 30.9 and Art. 39.2, respectively. Fortunately, the subtribal name Chesneyinae was already validly published a year earlier by Ranjbar et al. (2014: 82) with a full English diagnosis. Here, the subtribal name is formally raised to tribal rank with a full and direct reference to the original description in order to correct the publication of Chesneyeae.

Chesneyeae Ezedin, *trib. nov.*, based on Chesneyinae Ranjbar, F. Hajmoradi, & Waycott in Feddes Repert. 125(3–4): 82. TYPE: *Chesneya* Lindl. ex Endl., Gen. Pl.: 1275. 1840.

16. Genistodae Ezedin, *supertrib. nov.*, based on Genistoideae F. Schwarz, Forstl. Bot.: 347. Oct 1891. [subfam. Papilionoideae]
TYPE: *Genista* L., Sp. Pl. 709. 1753.

Included tribes: Brongniartieae Hutch.; Camoensieae Yakovlev; Crotalariae Hutch.; Diplotropideae Yakovlev; Genisteae Bronn; Ormosieae Yakovlev; Podalyriaceae Benth.; and Sophoreae Spreng. ex DC.

Informally known as the genistoids clade. Here, the expanded concept of the group is adopted, which includes Ormosieae (Wojciechowski et al., 2004). The monophyly of the clade as a whole is strongly supported in molecular studies (LPWG, 2017; Zhao et al., 2021). Although not known by any morphological synapomorphies, the genistoids are perhaps best known for their accumulation of quinolizidine alkaloids (Cardoso et al., 2013). The group also has been described as representing an evolutionarily transitory clade based on its topological position in relation to the rest of the Papilionoideae along with evidence from their flavonoid and alkaloid chemistry (Feitoza and Lima, 2021).

There are at least five genera that remain unplaced to tribal level within the supertribe: *Cabari* Gregório & D.B.O.S. Cardoso, *Neoharmsia* R. Vig., *Orphanodendron* Barneby & J.W. Grimes, *Pericopsis* Thwaites, and *Sakoanala* R. Vig. Despite sharing similar alkaloid chemistry with the genistoids, the exact placement of *Dermatophyllum* Scheele continuous to remain uncertain even after recent phylogenomic efforts (Choi et al., 2022). The tribe Diplotropideae is often referred to as “Leptolobieae” in recent literature; however, neither authorship nor original publication source for this name could be found.

17. Myroxyloidae Ezedin, *supertrib. nov.* [subfam. Papilionoideae]

TYPE: *Myroxylon* L. f., Suppl. Pl.: 34. 1782.

Small understory to large and buttressed canopy trees. Leaves alternate, compound imparipinnate, (3–)6–19(–43)-foliolate, the leaflets often with translucent dots and streaks. Inflorescences paniculate or racemose, terminal, axillary, or ramiflorous to cauliflorous. Flowers dioecious or rarely androdioecious, variously papilionoid, sub-papilionoid, caesalpinoid, irregular, or mimosoid in general appearance, pedicellate, the pedicels often bracteolate; calyx persistent, often large, cup-shaped or tubular, truncate or lobed, sometimes splitting into (2–)3(–5) reflexed lobes at anthesis; petals present or reduced (rarely absent), 5-merous, the vexillum often large and prominent, the wing and keel petals similar, often reduced (rarely absent); stamens 10(–many), free to weakly connate at the base; ovary stipitate, ellipsoid to elongate-linear. Fruits leguminous or globose to ellipsoid drupe-like pods or rarely two-winged samaras.

Included tribes: Amburaneae Nakai; Angylocalyceae Yakovlev; and Dipterygeae Polhill

Informally known as the ADA clade. This small group of tribes is well-supported as sister to the remainder of the Papilionoideae (Cardoso et al., 2013; Zhao et al., 2021). Although monophyletic, this clade is not known to have any clear morphological synapomorphies, as both floral and fruit characters for the group are highly heterogeneous. This supertribe is almost entirely Neotropical, with the exception of the African genera *Angylocalyx* Taub., *Cordyla* Lour., *Mildbraediendron* Harms, the Malagasy *Dupuya* J.H. Kirkbr., the Afro-Malagasy *Xanthocercis* Baill., and the Australian *Castanospermum* A. Cunn. ex Mudie. The members of this group are largely confined to tropical wet forests but are also found to a lesser extent in seasonally dry forests and woodlands. Several species often become large emergent canopy trees of commercial value.

Myroxylon (of Amburaneae) is chosen as the type genus. It is one of the oldest genus names published in the group and is among the most economically important, namely for its timber and aromatic balsam resin.

18. Phaseolodae Ezedin, *supertrib. nov.*, based on Phaseoloideae Burnett in Outlines Bot.: 661. 1835. [subfam. Papilionoideae]

TYPE: *Phaseolus* L., Sp. Pl. 723. 1753.

Included tribes: Abreae Baill.; Diocleae Hutch.; Indigofereae Benth.; Millettiae Miq.; and Phaseoleae DC.

Informally known as the millettoids or phaseoloids clade. The tribal makeup of this clade still needs further clarification, while the limits of the current tribes need revision. Here, four tribes are listed, corresponding to the four largest cladistic divisions of the supertribe. There remain at least six genera that are as of yet unplaced to tribal level: *Aganope* Miq., *Austrostenisia* R. Geesink, *Craibia* Harms & Dunn, *Dalbergiella* Baker f., *Dewevrea* Micheli, and *Ostryocarpus* Hook. f. (Zhao et al., 2021; Choi et al., 2022). The large and speciose tribe Phaseoleae s.l., which here encompasses Psoraleae, is likely worthy of being given

a subtribal classification. The supertribe is here cladistically defined as the most inclusive clade incorporating *Indigofera* L. and *Psoralea* L. but excluding Galegoideae, which is the immediate sister to this clade (Zhao et al., 2021).

Despite being traditionally excluded from the phaseoloids clade, Indigofereae is here included in the supertribe, as it has a well-supported sister relationship to the rest of the supertribe (Choi et al., 2022). The monotypic Malagasy *Disynstemon* R. Vig. is currently considered unplaced within this supertribe (Vatanparast et al., 2018). The genus was previously recovered as sister to Indigofereae by Schrire et al. (2009), but the authors stopped short of including it within the tribe.

POACEAE

Supertribes have been recognized in the grass family since 1980, when the first names were published at this rank (Liu, 1980). In the latest revision of the internal classification of Poaceae, the rank of supertribe is recognized for the subfamilies Panicoideae and Pooideae, each currently containing 14 and 15 accepted tribes, respectively (Soreng et al., 2017). A total of eight supertribes have thus far been named to allow for further resolution of the family's internal hierarchy. Here, only five of them are accepted. Two of them, supertribes Panicoideae and Pooideae, are ignored, as they each currently contain a single tribe, Paniceae and Poeae, respectively. Thus, they are deemed unnecessary lest any new tribally ranked taxa be described or the current tribes themselves be split apart. Additionally, the formerly recognized supertribe Bambusoideae is no longer accepted, as it merely encompasses two of the three tribes making up the subfamily Bambusoideae (Bambuseae and Olyreae), thus rendering it taxonomically ineffective as per Soreng et al. (2017).

19. Andropogonodae L. Liu, Acta Phytotax. Sin. 18: 325. 1980. (*Andropogonodae*) [subfam. Panicoideae]
TYPE: *Andropogon* L., Sp. Pl. 1045. 1753.

Included tribes: Andropogoneae Dumort.; Arundinelleae Stapf; Jansenelleae Voronts.; and Paspaleae J. Presl

According to Soreng et al. (2017), members of the supertribe tend to exhibit a base chromosome number of $x = 10$ along with the occurrence of paired spikelets, which are commonly sessile and pedicelled.

20. Melicodae Soreng, J. Syst. Evol. 55(4): 263. 2017. [subfam. Pooideae]
TYPE: *Melica* L., Sp. Pl. 66. 1753.

Included tribes: Brylkiniae Tateoka and Meliceae Link ex Endl.

Some common traits of the supertribe include fused leaf sheaths, multi-flowered spikelets, two lodicules, two subapical styles with persistent bases, and caryopses that are hard without lipid and compound starch grains and with a long linear hilum (Soreng et al., 2017).

21. Nardodae Soreng, J. Syst. Evol. 55(4): 263. 2017. [subfam. Pooideae]

TYPE: *Nardus* L., Sp. Pl. 53. 1753.

Included tribes: Lygeae Willk. and Nardeae W.D.J. Koch

This clade represents the second earliest diverging node in Pooideae. Each tribe contains a single genus, both of which apparently share little in common. In the linear sequence of Soreng et al. (2017), the tribes Duthieae Röser & Jul. Schneid. and Phaenospermateae Renvoize & Clayton appear to be erroneously listed under this supertribe but are not immediately sister to the [Lygeae + Nardeae] clade; instead, both tribes themselves form a sister clade that is successively sister to the rest of the subfamily. Thus, the clade [Duthieae + Phaenospermateae] could possibly be recognized as a separate supertribe.

22. Stipodae L. Liu, Acta Phytotax. Sin. 18: 324. 1980. [subfam. Pooideae]

TYPE: *Stipa* L., Sp. Pl. 78. 1753.

Included tribes: Ampelodesmeae Tutin and Stipeae Martinov

Soreng et al. (2017) note that this supertribe could possibly be expanded to incorporate the early diverging tribes Duthieae and Phaenospermateae on some morphological grounds, but then the supertribe would appear to be rendered paraphyletic. In the linear sequence of Soreng et al. (2017), the tribes Brachypodieae and Diarrheneae appear to be listed under this supertribe but are not sister to the [Ampelodesmeae + Stipeae] clade; instead, both tribes appear phylogenetically isolated, forming a grade leading up to the Triticodae.

23. Triticodae T.D. Macfarl. & L. Watson, Taxon 31(2): 192. 1982. (*Triticanae*) [subfam. Pooideae]

TYPE: *Triticum* L., Sp. Pl. 85. 1753.

Included tribes: Bromeae Martinov; Littledaleae Soreng & J.I. Davis; and Triticaceae Dumort.

Originally described by Macfarlane and Watson (1982). Sister to the Pooideae (not recognized here), this supertribe is often compared to the latter and can be distinguished from it along some morphological lines. The presence of branched fructans appears to be a key chemical factor that distinguishes members of Triticodae from Poeae (Bonnert et al., 1997).

ROSACEAE

Although not as large as the other families here in terms of genera and tribes, the Rosaceae were nonetheless assigned a supertribal classification by Potter et al. (2007). Three supertribes were recognized by those authors: two in subfamily Maloideae (sometimes as Amygdaloideae), currently with nine tribes, and one in subfamily Rosoideae, with six tribes. The two supertribes in Maloideae were used to group two pairs of tribes and are accepted here. However, the three supertribal names in this family were all originally published without a morphological description, the authors instead providing a purely cladistic definition based on molecular sequences. This does not meet the requirements for proper validation under the *Code* which requires morphological descriptions be used in validating names (Turland et al., 2018). Subsequent publications on Rosaceae have continued to refer to the supertribes, despite all three names remaining invalid (Zhang et al., 2017; Sun et al., 2018). Although the cladistic definitions given by Potter et al. (2007) remain unchanged, in order to validate their publication, brief diagnostic descriptions are provided here.

The single supertribe named for Rosoideae, the Rosodae, is neither recognized nor validated here, as it was originally defined to encompass the entire subfamily except *Filipendula* Mill., the sole member of tribe Ulmarieae. This does not convey additional taxonomic information, as the proposed supertribe essentially covers the entire subfamily minus the basalmost tribe. Additionally, in the Maloideae, despite the use of genomic-level data (Xiang et al., 2016; Sun et al., 2024), much confusion remains regarding the phylogenetic placements of the tribes Lyonothamneae, Sorbarieae, and Spiraeae, likely due to ancient hybridization along their stems.

24. Kerriodae Ezedin, *supertrib. nov.* [subfam. Maloideae]
TYPE: *Kerria* DC., Trans. Linn. Soc. London 12: 156. 1818.

Shrubs to small trees; unarmed or rarely armed. Monoecious, rarely dioecious. Leaves simple, stipulate, margins once to doubly serrate (rarely entire). Inflorescences terminal, solitary on short shoots or racemose. Flowers (4-) or 5-merous, bisexual or unisexual, stamens many, pistils (2-)5(-8). Fruits drupaceous achenes or coccetums.

Included tribes: Kerrieae Focke and Exochordeae Schulze-Mentz ex Reveal

Originally circumscribed with two tribes, both of which have been consistently recovered as sisters. The placement of

Sorbarieae in relation to the supertribe appears to fluctuate. It appears sister to the [Kerrieae + Exochordeae] clade with strong support in the phylogeny by Xiang et al. (2016: ML BS = 97) and more recently in the large tree by Baker et al. (2022). Yet another recent study demonstrated a notable conflict in the tribal topologies recovered from nuclear and plastid genomes (Hodel et al., 2022). In the prior study by Potter et al. (2007), Sorbarieae was recovered, with weak support, in an isolated position as sister to an even more weakly-defined [Spiraeae + Pyrodae] clade. It is plausible the supertribe could be expanded to incorporate Sorbarieae; however, this may be unwarranted given the outstanding topological conflicts outside this clade.

25. Pyrodae Ezedin, *supertrib. nov.* [subfam. Maloideae]
TYPE: *Pyrus* L., Sp. Pl. 479. 1753.

Trees, shrubs, or perennial rhizomatous herbs. Leaves simple or 3-foliolate, stipulate, margins serrate. Inflorescences terminal, corymbose or compound racemes. Flowers 5-merous, bisexual, stamens 10–20, pistils 5. Fruits indehiscent fleshy pomes, achenes, or dry dehiscent follicles.

Included tribes: Gillenieae Maxim. and Maleae Small

The origins of this economically important supertribe, while still not entirely clear, appears to be the result of ancient hybridization between distantly related tribes—likely involving the ancestors of the modern-day Spiraeae, Sorbarieae, and [Kerrieae + Exochordeae] clades (Hodel et al., 2022). Due to this, the sister clade to this supertribe is unresolved with the placement of either Spiraeae or Sorbarieae appearing with near equal likelihood. Potter et al. (2007) make a preliminary note that members of this clade appear to exhibit an association with rust fungi from the genus *Gymnosporangium* (Pucciniaceae) and *Phragmidium* (Phragmidiaceae). The tribe Maleae is sometimes referred to as Pyrae in older publications.

The genus *Gillenia* Moench, traditionally placed in its own tribe, Gillenieae, was suggested for reclassification as a subtribe in an expanded Maleae s.l. by Sun et al. (2024), with the authors arguing against upholding a monotypic tribe for the genus. If this is preferred, the supertribe would become defunct. However, the tribe is retained here as there are some notable differences, mainly the diploid chromosome count of $x = 9$ (vs. tetraploid $x = 15$ or 17), herbaceous habit (vs. woody trees or shrubs), flowers with bilateral symmetry (vs. radial), and compound leaves (vs. simple or lobed).

RUBIACEAE

Rubiaceae are among the most tribally diverse families. Formerly circumscribed with three subfamilies, recent phylogenomic studies have revealed conflicts between the traditional Cinchonoideae s.s. and Ixoroideae subfamilies, eventually leading to the proposal of merging the two into a single subfamily as Cinchonoideae s.l. (Rydin et al., 2017; Antonelli et al., 2021), more recently renamed to Dialypetalanthoideae (Razafimandimbison and Rydin, 2024). Now with merely two subfamilies together housing an overwhelming 68 tribes, the need for additional resolution between the rank of subfamily and tribe becomes even more

justified. Recognizing this need early on, Robbrecht and Manen (2006) introduced the rank of supertribe for four well-known and well-supported supra-tribal clades in the Rubiaceae. The original published names contained the incorrect suffix ending “-idinae” which is corrected here. Five additional supertribes are newly validated here, giving a total of nine for the family, corresponding to the nine tribal alliances outlined in Razafimandimbison and Rydin (2024).

All tribes in Rubioideae except Coussareeae are assigned to a supertribe, whereas four tribes in Dialypetalanthoideae remain without supertribal placement. It should be noted that

none of the 38 tribes of Dialypetalanthoideae s.l. currently have any accepted subtribal classifications. However, there are a few tribes large enough to potentially accommodate a future subtribal classification.

26. Cinchonodae Robbr. & Manen, Syst. & Geogr. Pl. 76: 134. 2006. (*Cinchonidinae*) [subfam. Dialypetalanthoideae] TYPE: *Cinchona* L., Sp. Pl. 172. 1753.

Included tribes: Chiococceae Benth. & Hook. f.; Chioneae Razafim. & Rydin; Cinchoneae DC.; Guettardeae DC.; Hamelieae A. Rich. ex DC.; Hillieae Bremek. ex S.P. Darwin; Hymenodictyoneae Razafim. & B. Bremer; Isertieae A. Rich. ex DC.; Naucleae Burnett; Rondeletieae Burnett; and Strumpfieae Delprete & Motley

This supertribe encompasses the subfamily Cinchonoideae *sensu stricto*, before its recent merger with Ixoroideae (see justifications by Antonelli et al., 2021; Razafimandimbison and Rydin, 2024). Long recognized as a distinct subfamily from Ixoroideae, this clade is here designated at supertribal level as a means of preserving its taxonomic recognition at rank level post-merger.

27. Coffeodae Ezedin, *supertrib. nov.* [subfam. Dialypetalanthoideae] TYPE: *Coffea* L., Sp. Pl. 172. 1753.

Monocaul to pachycaul trees, shrubs, lianas, (hemi-) epiphytes or herbs. Monoecious or dioecious. Raphides absent. Stipules intrapetiolar, entire or apiculate (rarely fimbriate), rarely sheathing. Inflorescences (pseudo-)terminal or axillary, sessile or pedunculate, solitary to multiflorous, paniculate, cymose, rarely thyrsoid or corymbose. Flowers hermaphroditic (rarely gynomonocious), 4–5(–12)-merous, calyx often persistent (rarely expanded and petaloid), corolla aestivation contorted left (rarely right), anthers exerted (rarely included), ovaries usually 2-locular. Fruits indehiscent fleshy berries or drupes (rarely dehiscent dry schizocarps). Pollen usually in monads, (2–)3–4(–7)-aperturate, usually colporate.

Included tribes: Alberteae Sond.; Augusteae Kainul. & B. Bremer; Bertiereae Bridson; Coffeae DC.; Cordiereae A. Rich. ex DC.; Gardenieae A. Rich. ex DC.; Octotropideae Bedd.; Pavetteae Dumort.; and Sherbournieae Mouly & B. Bremer

Informally known as the Coffeae alliance but alternatively referred to as the Gardenieae alliance by some older publications. Since Robbrecht and Manen (2006) had treated this clade as part of a broader Vanguerieae alliance, they never adopted a supertribal name for the group. This clade has long been known in the literature, as it represents a critical node in the family's phylogeny. A highly derived and well-diversified clade, it is nested deeply within the Cinchonoideae and is molecularly well established (Wikström et al., 2020; Antonelli et al., 2021). Of the included tribes, Alberteae is among the most morphologically deviant, whereas Octotropideae is the most poorly known and characterized. The tribe Airospemeae, formerly included here, was excluded by Razafimandimbison and Rydin (2024) due to lingering uncertainty in its placement with respect to this clade.

28. Dialypetalanthodae Ezedin, *supertrib. nov.* [subfam. Dialypetalanthoideae]

TYPE: *Dialypetalanthus* Kuhlman, Arch. Jard. Bot. Rio de Janeiro 4: 363. 1925.

Small to medium-sized trees or shrubs, rarely large trees or perennial herbs. Raphides absent, rod-like crystals and crystal sand sometimes present. Stipules interpetiolar or rarely intrapetiolar. Leaves simple, elliptic to ovate, decussate, or rarely whorled, petiolate, with or without domatia. Inflorescences terminal or axillary, thyrsoid or cymose (rarely solitary or fasciculate), bracteate, the bracts often persistent. Flowers bisexual, often pedicellate, (4-) or 5-merous, sometimes distylous, calyx campanulate to spreading, hypanthium present, narrowly obovoid, subcylindric, or globose, often lobed, corolla infundibular to salverform (hypocrateriform), often externally glabrous and pubescent inside, ovary 2-locular. Fruits capsules, globose to ellipsoid or flattened, rarely drupaceous, often with leathery to woody mesocarps, indehiscent or loculicidally (or septicidally) dehiscent. Seeds usually many, flattened, elliptic or circular, marginally winged or not.

Included tribes: Dialypetalantheae Reveal; Henriquezieae Benth. & Hook. f.; Posoquerieae Delprete; and Sipaneeae Bremek.

Informally referred to as the Dialypetalantheae (former Condamineae) alliance, comprising four tribes which in recent analyses have been found to form a clade, although there appears to be some conflict in their placements. The topology [Dialypetalantheae [Sipaneeae [Henriquezieae + Posoquerieae]]] was recovered in the plastid phylogeny by Kainulainen et al. (2013: Fig. 2) with rather weak support (BS = 72, PP = 79). The same clade, albeit with the placement of the first two tribes switched, was recovered in the coalescent nuclear trees recovered by Antonelli et al. (2021) and Baker et al. (2022), both with strong support. Contrasting both plastid and nuclear results, the mitochondrial-based phylogeny of Rydin et al. (2017), with only Sipaneeae and Posoquerieae sampled, showed the two as non-monophyletic in all analyses of their dataset except for the non-clock analysis of protein coding sequences (Appendix S3), where the tribes resolved as sisters. Additional support comes from the analyses of Thureborn et al. (2022), with only Dialypetalantheae and Posoquerieae sampled and nonetheless both resolving as sisters with strong support (BS, LPP = 100). Despite the strong support values seen in the recent studies, however, the ASTRAL trees appear to consistently show high incongruence in tree topologies, with alternate topologies being at equal to near equal frequencies to the species tree (Antonelli et al., 2021; Thureborn et al., 2022).

This supertribe is morphologically ambiguous and made up of taxa almost entirely restricted to the Neotropics. The biogeographic exceptions to this are the Asian genera *Dolicholobium* A. Gray, *Emmenopterys* Oliv., *Mastixiodendron* Melch., and *Mussaendopsis* Baill., along with the Nearctic genus *Pinckneya* Michx. from the southeast United States. Most genera are small, with less than 20 species. The largest genus, *Simira* Aubl., with ca. 40 species, is also the most widespread, covering an extensive range which

essentially overlaps with the entirety of the Neotropics realm (from Michoacán, México to Misiones, Argentina).

Dialypetalanthus (of Dialypetalantheae) automatically becomes the type of this supertribe by default due to its status as the type genus of a conserved family name, Dialypetalanthaceae (see Razafimandimbison and Rydin, 2024).

29. Ixorodae Robbr. & Manen, Syst. & Geogr. Pl. 76: 132. 2006. (*Ixoridinae*) [subfam. Dialypetalanthoideae]
TYPE: *Ixora* L., Sp. Pl. 110. 1753.

Included tribes: Aleisanthiae Mouly, J. Florence, & B. Bremer; Crossopterygeae F. White ex Bridson; Greeneae Mouly, J. Florence, & B. Bremer; Ixoreae Benth. & Hook. f.; Scyphiphoreae Kainul. & B. Bremer; Trailliaedoxeae Kainul. & B. Bremer; and Vanguerieae Dumort.

Informally known as the Vanguerieae alliance. This alliance has consistently been recovered as monophyletic using both plastid (Kainulainen et al., 2013; Wikström et al., 2020) and mitochondrial (Rydin et al., 2017) data. This consensus was somewhat challenged when a recent phylogenomic study based on nuclear genes recovered the alliance as a non-monophyletic grade leading up to the Coffeae alliance, albeit with poor support (Antonelli et al., 2021). This is in contrast to previous molecular results, which had recovered the Vanguerieae alliance as monophyletic with consistently good support. For now, the supertribe is accepted here with a cautionary note on possible cytonuclear discord resulting in conflicting topologies. Due to uncertainty in its placement, tribe Jackieae is currently considered unplaced to supertribe (Razafimandimbison and Rydin, 2024).

30. Lasianthodae Ezedin, *supertrib. nov.* [subfam. Rubioideae]
TYPE: *Lasianthus* Jack, Trans. Linn. Soc. London 14: 125. 1823.

Herbs or (sub)woody (sub)shrubs. Raphides present. Stipules interpetiolar, often persistent. Leaves opposite, subsessile to petiolate, rarely reduced or absent. Flowers axillary or rarely terminal, solitary, paired, cymose, or fasciculate, sessile or pedunculate, (4-) or 5-merous, corolla salverform or funnellform, aestivation valvate or imbricate, often villous inside, anthers included or exserted. Fruits indehiscent drupes or dehiscent dry capsules, usually with persistent calyx.

Included tribes: Lasiantheae B. Bremer & Manen and Perameae Bremek. ex S.P. Darwin

Informally known as the Perameae alliance. The two tribes are in a well-supported sister relationship according to multiple phylogenetic studies (Antonelli et al., 2021; Baker et al., 2022; Thureborn et al., 2022). Members of this group are distributed pantropically and are generally characterized by their shrubby habit. While the two tribes appear to share little in common morphologically, the genus *Perama* Aubl. is noted to be an aluminum hyperaccumulator similar to that of *Lasianthus* and *Trichostachys* Hook. f. (Robbrecht and

Manen, 2006). The inferred ancestral area of this supertribe is the Neotropics, with either long-distance dispersal or boreotropical expansion into the Paleotropics occurring in Lasiantheae within the last ca. 50 Ma (Smedmark et al., 2014).

31. Mussaendodae Ezedin, *supertrib. nov.*, based on Mussaendoideae Luerss., Handb. Syst. Bot. 2: 1083. [subfam. Dialypetalanthoideae]
TYPE: *Mussaenda* Burm. ex L., Sp. Pl. 177. 1753.

Included tribes: Mussaendeae Benth. & Hook. f. and Sabiceae A. Stahl

Informally known as the Mussaendeae alliance. This clade is well-supported and occupies a position along a grade within the former subfamily Ixoroideae, sister to a large clade that includes both the Vanguerieae and Coffeae alliances (Razafimandimbison and Rydin, 2024). The sister relationship of these two tribes is supported by several studies (Kainulainen et al., 2013; Rydin et al., 2017; Wikström et al., 2020).

32. Psychotriodae Robbr. & Manen, Syst. & Geogr. Pl. 76: 136. 2006. (*Psychotriidinae*) [subfam. Rubioideae]
TYPE: *Psychotria* L., Syst. Nat. ed. 10, 2: 929. 1759.

Included tribes: Craterispermeae Verdc.; Gaertnereae Endl.; Mitchelliae Razafim. & B. Bremer; Morindeae Burnett; Palicoureeae Robbr. & Manen; Prismatomerideae Y.Z. Ruan; Psychotrieae Cham. & Schltdl.; Schizocoleae Rydin & B. Bremer; and Schradereae Bremek.

Informally known as the Psychotrieae alliance. Sister to the Spermaceae alliance, from which it differs by its primarily woody habit. Biogeographical analyses show the tribal alliance had originated in Africa during the late Cretaceous, with numerous subsequent long-distance dispersals across oceans, continents, and island systems to result in its current pantropical distribution (Razafimandimbison et al., 2017).

33. Rubiodae Robbr. & Manen, Syst. & Geogr. Pl. 76: 137. 2006. (*Rubiidinae*) [subfam. Rubioideae]
TYPE: *Rubia* L., Sp. Pl. 109. 1753.

Included tribes: Anthospermeae Cham. & Schltdl.; Argostemmatae Bremek. ex Verdc.; Cyanoneuroneae Razafim. & B. Bremer; Danaideae B. Bremer & Manen; Dunniae Rydin & B. Bremer; Foonchewieae R.J. Wang; Knoxiae Benth. & Hook. f.; Paederiae DC.; Putoriae Lange; Rubiae Baill.; Spermaceae Cham. & Schltdl. ex DC.; and Theligoneae Baill.

Informally known as the Spermaceae alliance. Sister to the Psychotrieae alliance, from which it differs by its primarily herbaceous habit. Despite woodiness being considered an ancestral trait to the group, with the basalmost tribe Danaideae being woody, secondary woodiness has evolved in some of the more derived tribes such as Knoxiae and Spermaceae (Lens et al., 2009). Members of the supertribe are found in a wide variety of climates, both tropical and temperate.

34. Urophyllodae Ezedin, *supertrib. nov.*, based on Urophyllodeae Bremek. ex S.P. Darwin in Taxon 25: 607. 1976. [subfam. Rubioideae]

TYPE: *Urophyllum* Wall. in Roxb., Fl. Ind. 2: 184. 1824.

Included tribes: Colletocemateae Rydin & B. Bremer; Ophiorrhizeae Bremek. ex Verdc.; Seychelleae Razafim., Kainul., & Rydin; Temnopterygeae Razafim. & Rydin; and Urophyllae Bremek. ex Verdc.

Until recently, this family had no history of supertribal classification. However, advances in the understanding of the phylogeny of Sapindaceae have allowed for the recognition of supra-tribal clades at rank level in the largest and most diverse subfamily, Sapindoideae. The supertribe Paullinioidae was recently proposed by Acevedo-Rodríguez et al. (2017) to encompass four tribes. The publication of the supertribal name, which was not properly published by the authors, is corrected here and its limits expanded to cover a far greater extent of tribes. Additionally, a second supertribe is newly designated here to contain the remaining sister clade. Within Sapindoideae, all but four tribes are now placed into a supertribe, with internal relations summarized as follows: [Ungnadiaceae [Koelreuteriaceae [Schleichereae [Nephelieae [Cupanioidae + Paullinioidae]]]]] (Buerki et al., 2021). It should be noted that there are no tribes in Sapindoideae which currently have an assigned subtribal classification, although there are tribes within the subfamily which appear large enough to possibly allow future subtribal classifications (i.e., Cupanieae, Nephelieae, Sapindeae).

35. Cupanioidae Ezedin, *supertrib. nov.* [subfam. Sapindoideae]

TYPE: *Cupania* L., Sp. Pl. 200. 1753.

Trees or shrubs. Domatia often present. Leaves compound (rarely simple), alternate, 1- or 2-pinnate, pari- or imparipinnate, (2-)4-8(-22)-jugate, margins serrate or entire. Inflorescences (pseudo-)terminal, axillary, ramiflorous, or cauliflorous thyrsoid panicles or rarely racemose, with bracts and bracteoles often present. Flowers actinomorphic, functionally unisexual (rarely bisexual), sepals (4-)5(-6) or rarely absent, petals (4-)5(-7) or rarely absent, often clawed and/or with appendages, stamens (4-)5-8(-14), disk (semi)annular to 5-8-lobed, ovary (2-)3(-4)-carpellate, 1 ovule per carpel, stigma with 2-3 lobes or branches. Fruits dry dehiscent 1-3-locular capsules (rarely fleshy or indehiscent), sometimes hairy inside and out. Seeds usually arillate. Pollen syncolporate to parasycolporate (rarely colporate).

Included tribes: Cupanieae Blume and Stadmanieae Buerki & Callm.

Recovered as monophyletic and sister to Paullinioidae s.l. with strong support by Buerki et al. (2021) as the clades numbered 20 and 21. Likewise, the sister relation of the two tribes is well-supported in the analyses by Baker et al. (2022). Cupanieae, the largest tribe in the family, is

Informally referred to as the SCOUT clade by Thureborn et al. (2022) and the Urophyllae alliance by Razafimandimbison and Rydin (2024). This clade has been recovered as well-supported by several plastid and nuclear analyses (Kainulainen et al., 2013; Antonelli et al., 2021; Baker et al., 2022; Thureborn et al., 2022). However, in the mitochondrial analyses of Rydin et al. (2017), Ophiorrhizeae appears to disassociate from the [Colletocemateae + Urophyllae] clade.

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antropical, while Stadmanieae is restricted to the West Indian Ocean Islands region and tropical Africa.

36. Paullinioidae Avec.-Rodr. et al., Syst. Bot. 42: 108. 2017. [subfam. Sapindoideae]

TYPE: *Paullinia* L., Sp. Pl. 365. 1753.

Trees, shrubs, or lianas. Leaves compound (rarely simple and lobed), alternate, 1(-3)-pinnate, (1-)3(-5)-foliolate, or 1- or 2-ternate, pari- or imparipinnate, (1-)4-6(-8)-jugate, margins usually serrate. Inflorescences (pseudo-)terminal, axillary thyrses or cymes, or solitary (rarely in racemes or spikes). Flowers zygomorphic (rarely actinomorphic), bisexual or functionally unisexual, sepals 4-5(-7), petals (2-)4-5(-8) or rarely absent, often with appendages, sometimes clawed, stamens 5-8(-30), disk (semi)annular to (2-)4-8(-10)-lobed, ovary (1-)2-3(-5)-carpellate, 1 ovule per carpel, stigma (sub)capitate or with 3 lobes or branches. Fruits dry or (sub)fleshy, dehiscent or sometimes indehiscent, 1-3(-5)-locular capsules or schizocarps splitting into (1-)3 samaroid mericarps, the mericarps usually 1-winged. Seeds usually exarillate. Pollen usually colporate (rarely brevicolporate).

Included tribes: Athyaneae Acev.-Rodr.; Blomieae Buerki & Callm.; Bridgesieae Acev.-Rodr.; Guindilieae Buerki, Callm., & Acev.-Rodr.; Haplocoeleae Buerki & Callm.; Melicocceae Blume.; Thouiniaee Blume.; Tristropsidae Buerki & Callm.; Paullinieae DC.; and Sapindeae DC.

Although the supertribe was originally published with an English description, there are two issues surrounding its validation. First, the name was published without direct ascription or association of author(s) alongside the description, in a paper authored by ten people. In this case, according to Note 5 of Art. 46 and Art. 46.6 of the *Code* (Turland et al., 2018), the correct author(s) of the supertribe Paullinioidae are all ten authors of the paper (Acevedo-Rodríguez et al., 2017). Secondly, the supertribe was published without indication of the type. In this case, the type genus for Paullinioidae would be *Paullinia* L., but this was never cited by Acevedo-Rodríguez et al. (2017: 108). This goes against Art. 7.1 of the *Code*, which states names of taxa at the rank of family and below must include indication of the nomenclatural type to be validly published (Turland et al., 2018). The publication of the supertribe is corrected here.

Another separate issue involves the proposed limits of

the supertribe. Originally, the supertribe was delimited to encompass only four tribes representing the well-supported yet deeply-nested clade [Athyaneeae [Bridgesieae [Thouiniaeeae + Paullinieae]]] (Buerki et al., 2021). This clade was once formerly recognized as the subfamily Paullinioideae Burnett and then subsequently at tribal level as Paullinieae s.l. (Acevedo-Rodríguez et al., 2011). However, this does not represent the broadest available well-supported clade. Thus, the delimitation of the supertribe becomes phylogenetically uninformative toward Sapindoideae's major internal divisions. Here, Paulliniodae is expanded to encompass six additional tribes which form the broadest, most inclusive, well-supported node possible, corresponding to the clades numbered 10–19 in Buerki et al. (2021: Fig. 1, S2, S3).

The new Paulliniodae s.l. can be cladistically defined as the most inclusive clade incorporating *Tristira* Radlk. and *Paullinia* but excluding the broadest clade containing *Tina* Schult. and *Beguea* Capuron. Due to the considerable

changes to its circumscription proposed here, an emended general description inclusive of all 10 tribes is provided. Morphologically, Paulliniodae s.l. may now be characterized by its predominantly zygomorphic flowers (sometimes weakly so) and seeds mostly lacking arils, as opposed to the entirely actinomorphic Cupaniodae with seeds that are mostly arillate.

If recognition of the former Paulliniodae s.s. is desired at rank level, the four innermost tribes may again be reduced to subtribes, as they previously were under the broadened Paullinieae s.l. tribal concept (Acevedo-Rodríguez et al., 2011). This solution may also prove beneficial given the rank of subtribe has yet to be filled in the subfamily. However, Acevedo-Rodríguez et al. (2017) state that it would not be preferable to recognize the *sensu lato* concept of tribe Paullinieae, instead arguing to keep it limited to its *sensu stricto* delimitation to allow for ease of morphological recognition at tribal level. Their suggestion is followed here, and the tribal limits retained as is.

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APPENDIX I

List of all known published supertribal names and their full citations, excluding new names proposed in this account. Accepted names appear in bold, synonymized or invalid names in italics.

- Andropogonodae** L. Liu in Acta Phytotax. Sin. 18: 325. 1980. (*Andropogodae*) [Poaceae]
- Arabodae** D.A. German et al., PhytoKeys 220: 129. 2023. [Brassicaceae]
- Arundinarodae* L. Liu in Acta Phytotax. Sin. 18: 324. 1980. [Poaceae]
- Arundinodae* L. Liu in Acta Phytotax. Sin. 18: 324. 1980. (*Arundodae*) [Poaceae]
- Asterodae** H. Rob. in Phytologia 87: 73. 2005. [Asteraceae]
- Bambusodae* L. Liu in Acta Phytotax. Sin. 18: 323. 1980. [Poaceae]
- Brassicodae** V.E. Avet. in Biol. Zhurn. Armenii 43: 602. 1990. (*Brassicidinae*) [Brassicaceae]
- Camelinodae** D.A. German et al., PhytoKeys 220: 130. 2023. [Brassicaceae]
- Cinchonodae** Robbr. & Manen in Syst. & Geogr. Pl. 76: 134. 2006. (*Cinchonidinae*) [Rubiaceae]
- Eragrostodae* L. Liu in Acta Phytotax. Sin. 18: 324. 1980. [Poaceae]
- Helianthodae** H. Rob. in Phytologia 86: 118. 2004. [Asteraceae]
- Heliophilodae** D.A. German et al., PhytoKeys 220: 131. 2023. [Brassicaceae]
- Hesperodae** D.A. German et al., PhytoKeys 220: 132. 2023. [Brassicaceae]
- Ixorodae** Robbr. & Manen in Syst. & Geogr. Pl. 76: 132. 2006. [Rubiaceae]
- Kerriodae* D. Potter, S.H. Oh, & K.R. Robertson in D. Potter et al., Pl. Syst. Evol. 266: 38. 2007. *nom. inval.* [Rosaceae]
- Melicodae** Soreng, J. Syst. Evol. 55(4): 263. 2017. [Poaceae]
- Nardodae** Soreng, J. Syst. Evol. 55(4): 263. 2017. [Poaceae]
- Olyrodae* Soderstr. & R.P. Ellis in T. R. Soderstrom et al. (eds.), Grass Syst. Evol.: 238. 1988. [Poaceae]
- Oryzodae* L. Watson, Clifford, & Dallwitz in Austral. J. Bot. 33: 458. 1985. (*Oryzanae*) [Poaceae]
- Panicodae* L. Liu in Acta Phytotax. Sin. 18: 324. 1980. [Poaceae]
- Paulliniodae** Avec.-Rodr. et al., Syst. Bot. 42: 108. 2017. [Sapindaceae]
- Pharodae* L. Liu in Acta Phytotax. Sin. 18: 324. 1980. [Poaceae]
- Poodae* L. Liu in Acta Phytotax. Sin. 18: 324. 1980. [Poaceae]
- Psychotriodae** Robbr. & Manen in Syst. & Geogr. Pl. 76: 136. 2006. (*Psychotriidinae*) [Rubiaceae]
- Pyrodae* C.S. Campbell, R.C. Evans, D.R. Morgan, & T.A. Dickinson in D. Potter et al., Pl. Syst. Evol. 266: 39. 2007. *nom. inval.* [Rosaceae]
- Rosodae* T. Eriksson, Smedmark, & M.S. Kerr in D. Potter et al., Pl. Syst. Evol. 266: 36. 2007. *nom. inval.* [Rosaceae]
- Rubiodae** Robbr. & Manen in Syst. & Geogr. Pl. 76: 137. 2006. (*Rubiidinae*) [Rubiaceae]
- Senecionodae* H. Rob. in Phytologia 86: 119. 2004. [Asteraceae]
- Sisymbriodae* V.E. Avet. in Biol. Zhurn. Armenii 43: 602. 1990. (*Sisymbriidinae*) [Brassicaceae]
- Stipodae** L. Liu in Acta Phytotax. Sin. 18: 324. 1980. [Poaceae]
- Thelypodiodae* V.E. Avet. in Biol. Zhurn. Armenii 43: 602. 1990. (*Thelypodiinae*) [Brassicaceae]
- Triticodae** T.D. Macfarl. & L. Watson, Taxon 31(2): 192. 1982. (*Triticanae*) [Poaceae]

APPENDIX II

List of accepted supertribal taxa recognized in the angiosperms and their respective subordinate taxa. Genera and species count data mostly taken from the World Checklist of Vascular Plants database (WCVP, <https://wcvp.science.kew.org/>, initially accessed January–February 2022), with emendations taken from recent literature.

FAMILY	SUBFAMILY	SUPERTRIBE	NO. TRIBES	NO. GENERA	NO. SPECIES
Araceae	Aroideae	Arodae	12	41	1069
Araceae	Aroideae	Philodendrodae	6	27	984
Araceae	Aroideae	Schismatoglottidodae	3	4(–33) ^a	300
Araceae	Aroideae	Zamioculcadodae	2	3	26
Asteraceae	Asteroideae	Asterodae	4	532	7518
Asteraceae	Asteroideae	Helianthodae	15	558	6938
Brassicaceae	Brassicoideae	Arabodae	4	46	844
Brassicaceae	Brassicoideae	Brassicodae	15	123	916
Brassicaceae	Brassicoideae	Camelinodae	18	86	1478
Brassicaceae	Brassicoideae	Heliophilodae	8	27	198
Brassicaceae	Brassicoideae	Hesperodae	7	47	354
Cactaceae	Cactoideae	Cereodae	2	58	688
Cactaceae	Cactoideae	Echinocereodae	3	38	286
Fabaceae	Papilionoideae	Dalbergiodae	2	55	1574
Fabaceae	Papilionoideae	Galegodae	12	70	5931
Fabaceae	Papilionoideae	Genistodae	8	95	2854
Fabaceae	Papilionoideae	Myroxylodae	3	18	79
Fabaceae	Papilionoideae	Phaseolodae	4	203	3638
Poaceae	Panicoideae	Andropogonodae	4	135	1917
Poaceae	Pooideae	Melicodae	2	8	147
Poaceae	Pooideae	Nardodae	2	2	2
Poaceae	Pooideae	Stipodae	2	34	547
Poaceae	Pooideae	Triticodae	3	25	568
Rosaceae	Maloideae	Kerriodae	2	7	11
Rosaceae	Maloideae	Pyrodae	2	45	1158
Rubiaceae	Dialypetalanthoideae	Cinchonodae	11	117	1728
Rubiaceae	Dialypetalanthoideae	Coffeodae	9	142	2048
Rubiaceae	Dialypetalanthoideae	Ixorodae	8	39	1246
Rubiaceae	Dialypetalanthoideae	Mussaendodae	2	11	385
Rubiaceae	Dialypetalanthoideae	Dialypetalanthodae	4	48	396
Rubiaceae	Rubioideae	Lasianthodae	2	6	348
Rubiaceae	Rubioideae	Psychotriodae	9	45	3486
Rubiaceae	Rubioideae	Rubiodae	13	146	3312
Rubiaceae	Rubioideae	Urophyllodae	5	24	699
Sapindaceae	Sapindoideae	Cupaniodae	2	46	528
Sapindaceae	Sapindoideae	Paulliniodae	10	34	953 ^b

^a Generic concepts in Schismatoglottideae are contentious.

^b Species count varies depending on the concept of the genus *Allophylus* L.