

Angiosperm Phylogeny Group (APG) system

The Angiosperm Phylogeny Group, or APG, refers to an informal international group of systematic botanists who came together to try to establish a consensus view of the taxonomy of flowering plants (angiosperms) that would reflect new knowledge about their relationships based upon phylogenetic studies.

As of 2010, three incremental versions of a classification system have resulted from this collaboration (published in 1998, 2003 and 2009).

An important motivation for the group was what they viewed as deficiencies in prior angiosperm classifications, which were not based on monophyletic groups (i.e. groups consisting of all the descendants of a common ancestor).

APG publications are increasingly influential, with a number of major herbaria changing the arrangement of their collections to match the latest APG system.

Angiosperm classification and the APG

Until detailed genetic evidence became available, the classification of flowering plants (also known as angiosperms, *Angiospermae*, *Anthophyta* or *Magnoliophyta*) was based on their morphology (particularly that of the flower) and their biochemistry (what kinds of chemical compound they contained or produced).

Classification systems were typically produced by an individual botanist or by a small group. The result was a large number of such systems (see List of systems of plant taxonomy).

Different systems and their updates tended to be favoured in different countries; e.g. the Engler system in continental Europe; the Bentham & Hooker system in Britain (particularly influential because it was used by Kew); the Takhtajan system in the former Soviet Union and countries within its sphere of influence; and the Cronquist system in the United States.

History of classification

The botanical term "Angiosperm", from the Ancient Greek ἀγγεῖον, angeíon (receptacle, vessel) and σπέρμα, (seed), was coined in the form *Angiospermae* by Paul Hermann in 1690, as the name of that one of his primary divisions of the plant kingdom.

This included flowering plants possessing seeds enclosed in capsules, distinguished from his *Gymnospermae*, or flowering plants with achenial or schizo-carpic fruits, the whole fruit or each of its pieces being here regarded as a seed and naked.

The term and its antonym were maintained by Carolus Linnaeus with the same sense, but with restricted application, in the names of the orders of his class *Didynamia*.

Its use with any approach to its modern scope only became possible after 1827, when Robert Brown established the existence of truly naked ovules in the *Cycadeae* and *Coniferae*, and applied to them the name Gymnosperms.

From that time onwards, so long as these Gymnosperms were, as was usual, reckoned as dicotyledonous flowering plants, the term Angiosperm was used antithetically by botanical writers, with varying scope, as a group-name for other dicotyledonous plants.

In 1851, Hofmeister discovered the changes occurring in the embryo-sac of flowering plants, and determined the correct relationships of these to the Cryptogamia.

This fixed the position of Gymnosperms as a class distinct from Dicotyledons, and the term Angiosperm then gradually came to be accepted as the suitable designation for the whole of the flowering plants other than Gymnosperms, including the classes of Dicotyledons and Monocotyledons. This is the sense in which the term is used today.

In most taxonomies, the flowering plants are treated as a coherent group.

The most popular descriptive name has been *Angiospermae* (Angiosperms), with *Anthophyta* ("flowering plants") a second choice. These names are not linked to any rank.

The Wettstein system and the Engler system use the name *Angiospermae*, at the assigned rank of subdivision.

The Reveal system treated flowering plants as subdivision Magnoliophytina (Frohne & U. Jensen ex Reveal, *Phytologia* 79: 70 1996), but later split it to *Magnoliopsida*, *Liliopsida* and *Rosopsida*.

The Takhtajan system and Cronquist system treat this group at the rank of division, leading to the name *Magnoliophyta* (from the family name *Magnoliaceae*).

The Dahlgren system and Thorne system (1992) treat this group at the rank of class, leading to the name Magnoliopsida. The APG system of 1998, and the later 2003 and 2009 revisions, treat the flowering plants as a clade called angiosperms without a formal botanical name. However, a formal classification was published alongside the 2009 revision in which the flowering plants form the Subclass Magnoliidae.

The internal classification of this group has undergone considerable revision.

The Cronquist system, proposed by Arthur Cronquist in 1968 and published in its full form in 1981, is still widely used but is no longer believed to accurately reflect phylogeny. A consensus about how the flowering plants should be arranged has recently begun to emerge through the work of the Angiosperm Phylogeny Group (APG), which published an influential reclassification of the angiosperms in 1998.

Updates incorporating more recent research were published as APG II in 2003 and as APG III in 2009.

Traditionally, the flowering plants are divided into two groups, which in the Cronquist system are called Magnoliopsida (at the rank of class, formed from the family name *Magnoliaceae*) and Liliopsida (at the rank of class, formed from the family name *Liliaceae*). Other descriptive names allowed by Article 16 of the ICBN include Dicotyledones or *Dicotyledoneae*, and Monocotyledones or *Monocotyledoneae*, which have a long history of use.

In English a member of either group may be called a dicotyledon (plural dicotyledons) and monocotyledon (plural monocotyledons), or abbreviated, as dicot (plural dicots) and monocot (plural monocots).

These names derive from the observation that the dicots most often have two cotyledons, or embryonic leaves, within each seed.

The monocots usually have only one, but the rule is not absolute either way. From a diagnostic point of view the number of cotyledons is neither a particularly handy nor reliable character.

Recent studies, as by the APG, show that the monocots form a monophyletic group (clade) but that the dicots do not (they are paraphyletic).

Nevertheless, the majority of dicot species do form a monophyletic group, called the eudicots or tricolpates. Of the remaining dicot species, most belong to a third major clade known as the *Magnoliidae*, containing about 9,000 species.

The rest include a paraphyletic grouping of primitive species known collectively as the basal angiosperms, plus the families Ceratophyllaceae and Chloranthaceae.

Flowering plant diversity

The number of species of flowering plants is estimated to be in the range of 250,000 to 400,000.

The number of families in APG (1998) was 462. In APG II (2003) it is not settled; at maximum it is 457, but within this number there are 55 optional segregates, so that th

The diversity of flowering plants is not evenly distributed. Nearly all species belong to the eudicot (75%), monocot (23%) and magnoliid (2%) clades. The remaining 5 clades contain a little over 250 species in total, i.e., less than 0.1% of flowering plant diversity, divided among 9 families.

The most diverse families of flowering plants, in their APG circumscriptions, in order of number of species, are:

- *Asteraceae* or *Compositae* (daisy family): 23,600 species;
- *Orchidaceae* (orchid family): 22,075 species;
- *Fabaceae* or *Leguminosae* (pea family): 19,400;
- *Rubiaceae* (madder family): 13,150;
- *Poaceae* or *Gramineae* (grass family): 10,035;
- *Lamiaceae* or *Labiatae* (mint family): 7,173;
- *Euphorbiaceae* (spurge family): 5,735;
- *Melastomataceae* (melastome family): 5,005;
- *Myrtaceae* (myrtle family): 4,620;
- *Apocynaceae* (dogbane family): 4,555.

In the list above (showing only the 10 largest families), the *Orchidaceae* and *Poaceae* are monocot families; the others are eudicot families.

The genetic evidence which became available from the 1980s onwards, analysed by phylogenetic methods, confirmed or clarified some relationships in existing systems of classification, but radically changed others. The rapid increase in knowledge led to many proposed changes; stability was "rudely shattered". This posed problems for all users of classification systems (including encyclopaedists).

In the late 1990s, an informal group of researchers from major institutions worldwide came together under the title of the 'Angiosperm Phylogeny Group' or APG.

Their intention was to provide a widely accepted and more stable point of reference for angiosperm classification. Their first attempt at a new system was published in 1998 (the APG system).

As of 2010, two revisions have been published, in 2003 (APG II) and in 2009 (APG III), each superseding the previous system. Eight researchers have been listed as authors to the three papers, and a further 33 as contributors.

A classification presents a view at a particular point in time, based on a particular state of research. Independent researchers, including members of the APG, continue to publish their own views on areas of angiosperm taxonomy.

Classifications change, however inconvenient this is to users.

However, the APG publications are increasingly regarded as an authoritative point of reference. Some examples:

- A significant number of major herbaria, including Kew, are changing the order of their collections in accordance with APG.
- The influential World Checklist of Selected Plant Families (also from Kew) is being updated to the APG III system.
- In the USA, a recent photographic survey of the plants of the USA and Canada is organized according to the APG II system.
- In the UK, the latest edition of the standard flora of the British Isles (by Stace) is based on the APG III system. The previous edition was based on the Cronquist system.

Peter F. Stevens, one of the authors of all three of the APG papers, maintains a web site, APweb, hosted by the Missouri Botanical Garden, which has been regularly updated since 2001, and is a useful source for the latest research in angiosperm phylogeny which follows the APG approach.

Principles

The principles of the APG's approach to classification were set out in the first paper of 1998, and have remained unchanged in subsequent revisions. Briefly, these are:

- The Linnean system of orders and families should be retained. "The family is central in flowering plant systematics." An ordinal classification of families is proposed as a "reference

tool of broad utility". Orders are considered to be of particular value in teaching and in studying family relationships.

- Groups should be monophyletic (i.e. consist of *all* descendants of a common ancestor). The main reason why existing systems are rejected is because they do not have this property, they are not phylogenetic.
- A broad approach is taken to defining the limits of groups. Thus of orders, it is said that a limited number of larger orders will be more useful. Families containing only a single genus and orders containing only a single family are avoided where this is possible without violating the over-riding requirement for monophyly.
- Although orders and families are used, above this level, named clades are freely employed in addition. (Some have later been given formal names in a paper associated with the 2009 revision of the APG system.) The authors say that it is "not possible, nor is it desirable" to name all clades in a phylogenetic tree; however, systematists need to agree on names for some clades, particularly orders and families, to facilitate communication and discussion.

APG I system

The initial 1998 paper by the APG made angiosperms the first large group of organisms to be systematically re-classified primarily on the basis of genetic characteristics.

The paper explains the authors' view that there is a need for a classification system for angiosperms at the level of families, orders and above, but that existing classifications are "outdated".

The main reason why existing systems are rejected is because they are not phylogenetic, i.e. are not based on strictly monophyletic groups (i.e. groups which consist of all descendants of a common ancestor).

An ordinal classification of flowering plant families is proposed as a "reference tool of broad utility". The broad approach adopted to defining the limits of orders resulted in the recognition of 40 orders, compared to, for example, 232 in Takhtajan's 1997 classification.

Other features of the proposed classification include:

- Formal, scientific names are not used above the level of order, named clades being used instead. Thus eudicots and monocots are not given a formal rank on the grounds that "it is not yet clear at which level they should be recognized".
- A substantial number of taxa whose classification had traditionally been uncertain are given places, although there still remain 25 families of "uncertain position".
- Alternative classifications are provided for some groups, in which a number of families can either be regarded as separate or can be merged into a single larger family. For example, the *Fumariaceae* can either be treated as a separate family or as part of *Papaveraceae*.

A major outcome of the classification is the disappearance of the traditional division of the flowering plants into two groups, monocots and dicots.

The monocots are recognized as a clade, but the dicots are not, with a number of former dicots being placed in separate groups basal to both monocots and the remaining dicots, the eudicots or "true dicots".

The APG system of plant classification is the first, now obsolete, version of a modern, mostly molecular-based, system of plant taxonomy that was published in 1998 by the Angiosperm Phylogeny Group.

It was superseded in 2003 by a revision, the APG II system, and then in 2009 by a further revision, the APG III system.

The original APG system is unusual in being based, not on total evidence, but on the cladistic analysis of the DNA sequences of three genes, two chloroplast genes and one gene coding for ribosomes.

Although based on molecular evidence only, its constituent groups prove to be supported by other evidence as well, for example pollen morphology supports the split between the eudicots and the rest of the former dicotyledons.

The system is rather controversial in its decisions at the family level, splitting a number of long-established families and submerging a number of other families.

It also is unusual in not using botanical names above the level of order, that is, an order is the highest rank that will have a formal botanical name in this system.

Higher groups are defined only as clades, with names such as monocots, eudicots, rosids, asterids.

The main groups in the system (all unranked clades) are:

- angiosperms :
 - monocots
 - commelinoids
 - eudicots
 - core eudicots
 - rosids
 - ❖ eurosids I
 - ❖ eurosids II
 - asterids
 - ❖ euasterids I
 - ❖ euasterids II

The APG system recognises 462 families and 40 orders: these are assigned as follows. In the beginning of each listing some families or orders that are not placed in a further clade:

- clade angiosperms
 - family *Amborellaceae*
 - family *Austrobaileyaceae*
 - family *Canellaceae*
 - family *Chloranthaceae*
 - family *Hydnoraceae*
 - family *Illiciaceae*
 - family *Nymphaeaceae* (+ family *Cabombaceae*)
 - family *Rafflesiaceae*
 - family *Schisandraceae*
 - family *Trimeniaceae*
 - family *Winteraceae*
 - order *Ceratophyllales*
 - family *Ceratophyllaceae*
 - order *Laurales*
 - family *Atherospermataceae*
 - family *Calycanthaceae*
 - family *Gomortegaceae*
 - family *Hernandiaceae*
 - family *Lauraceae*
 - family *Monimiaceae*
 - family *Siparunaceae*
 - order *Magnoliales*
 - family *Annonaceae*

- family *Degeneriaceae*
- family *Eupomatiaceae*
- family *Himantandraceae*
- family *Magnoliaceae*
- family *Myristicaceae*
- order *Piperales*
 - family *Aristolochiaceae*
 - family *Lactoridaceae*
 - family *Piperaceae*
 - family *Saururaceae*
- clade monocots
 - family *Corsiaceae*
 - family *Japonoliriaceae*
 - family *Nartheciaceae*
 - family *Petrosaviaceae*
 - family *Triuridaceae*
- order *Acorales*
 - family *Acoraceae*
- order *Alismatales*
 - family *Alismataceae*
 - family *Aponogetonaceae*
 - family *Araceae*
 - family *Butomaceae*
 - family *Cymodoceaceae*
 - family *Hydrocharitaceae*
 - family *Juncaginaceae*
 - family *Limnocharitaceae*
 - family *Posidoniaceae*
 - family *Potamogetonaceae*
 - family *Ruppiceae*
 - family *Scheuchzeriaceae*
 - family *Tofieldiaceae*
 - family *Zosteraceae*
- order *Asparagales*
 - family *Agapanthaceae*
 - family *Agavaceae*
 - family *Alliaceae*
 - family *Amaryllidaceae*
 - family *Anemarrhenaceae*
 - family *Anthericaceae*
 - family *Aphyllanthaceae*
 - family *Asparagaceae*
 - family *Asphodelaceae*
 - family *Asteliaceae*
 - family *Behniaceae*
 - family *Blandfordiaceae*
 - family *Boryaceae*
 - family *Convallariaceae*
 - family *Doryanthaceae*
 - family *Hemerocallidaceae*
 - family *Herreriaceae*

- family *Hyacinthaceae*
- family *Hypoxidaceae*
- family *Iridaceae*
- family *Ixioliriaceae*
- family *Lanariaceae*
- family *Laxmanniaceae*
- family *Orchidaceae*
- family *Tecophilaeaceae*
- family *Themidaceae*
- family *Xanthorrhoeaceae*
- family *Xeronemataceae*
- order *Dioscoreales*
 - family *Burmanniaceae*
 - family *Dioscoreaceae*
 - family *Taccaceae*
 - family *Thismiaceae*
 - family *Trichopodaceae*
- order *Liliales*
 - family *Alstroemeriaceae*
 - family *Campynemataceae*
 - family *Colchicaceae*
 - family *Liliaceae*
 - family *Luzuriagaceae*
 - family *Melanthiaceae*
 - family *Philesiaceae*
 - family *Ripogonaceae*
 - family *Smilacaceae*
- order *Pandanales*
 - family *Cyclanthaceae*
 - family *Pandanaceae*
 - family *Stemonaceae*
 - family *Velloziaceae*
- clade commelinoids
 - family *Abolbodaceae*
 - family *Bromeliaceae*
 - family *Dasypogonaceae*
 - family *Hanguanaceae*
 - family *Mayacaceae*
 - family *Rapateaceae*
- order *Arecales*
 - family *Arecaceae*
- order *Commelinales*
 - family *Commelinaceae*
 - family *Haemodoraceae*
 - family *Philydraceae*
 - family *Pontederiaceae*
- order *Poales*
 - family *Anarthriaceae*
 - family *Centrolepidaceae*
 - family *Cyperaceae*
 - family *Ecdeiocoleaceae*

- family *Eriocaulaceae*
- family *Flagellariaceae*
- family *Hydatellaceae*
- family *Joinvilleaceae*
- family *Juncaceae*
- family *Poaceae*
- family *Prioniaceae*
- family *Restionaceae*
- family *Sparganiaceae*
- family *Thurniaceae*
- family *Typhaceae*
- family *Xyridaceae*
- order *Zingiberales*
 - family *Cannaceae*
 - family *Costaceae*
 - family *Heliconiaceae*
 - family *Lowiaceae*
 - family *Marantaceae*
 - family *Musaceae*
 - family *Strelitziaceae*
 - family *Zingiberaceae*
- clade eudicots
 - family *Buxaceae*
 - family *Didymelaceae*
 - family *Sabiaceae*
 - family *Trochodendraceae* (+ family *Tetracentraceae*)
 - order *Proteales*
 - family *Nelumbonaceae*
 - family *Platanaceae*
 - family *Proteaceae*
 - order *Ranunculales*
 - family *Berberidaceae*
 - family *Circaeasteraceae* (+ family *Kingdoniaceae*)
 - family *Eupteleaceae*
 - family *Lardizabalaceae*
 - family *Menispermaceae*
 - family *Papaveraceae* (+ family *Fumariaceae* and family *Pteridophyllaceae*)
 - family *Ranunculaceae*
- clade core eudicots
 - family *Aextoxicaceae*
 - family *Berberidopsidaceae*
 - family *Dilleniaceae*
 - family *Gunneraceae*
 - family *Myrothamnaceae*
 - family *Vitaceae*
 - order *Caryophyllales*
 - family *Achatocarpaceae*
 - family *Aizoaceae*
 - family *Amaranthaceae*
 - family *Ancistrocladaceae*
 - family *Asteropeiaceae*

family *Basellaceae*
 family *Cactaceae*
 family *Caryophyllaceae*
 family *Didiereaceae*
 family *Dioncophyllaceae*
 family *Droseraceae*
 family *Drosophyllaceae*
 family *Frankeniaceae*
 family *Molluginaceae*
 family *Nepenthaceae*
 family *Nyctaginaceae*
 family *Phytenaceae*
 family *Phytolaccaceae*
 family *Plumbaginaceae*
 family *Polygonaceae*
 family *Portulacaceae*
 family *Rhabdodendraceae*
 family *Sarcobataceae*
 family *Simmondsiaceae*
 family *Stegnospermataceae*
 family *Tamaricaceae*
 order *Santalales*
 family *Olacaceae*
 family *Opiliaceae*
 family *Loranthaceae*
 family *Misodendraceae*
 family *Santalaceae*
 order *Saxifragales*
 family *Altingiaceae*
 family *Cercidiphyllaceae*
 family *Crassulaceae*
 family *Daphniphyllaceae*
 family *Grossulariaceae*
 family *Haloragaceae*
 family *Hamamelidaceae*
 family *Iteaceae*
 family *Paeoniaceae*
 family *Penthoraceae*
 family *Pterostemonaceae*
 family *Saxifragaceae*
 family *Tetracarpaeaceae*
 ➤ clade rosids
 family *Aphloiaceae*
 family *Crossosomataceae*
 family *Ixerbaceae*
 family *Krameriaceae*
 family *Picramniaceae*
 family *Podostemaceae*
 family *Stachyuraceae*
 family *Staphyleaceae*
 family *Tristichaceae*

family *Zygophyllaceae*
 order *Geraniales*
 family *Francoaceae*
 family *Geraniaceae* (+ family *Hypseocharitaceae*)
 family *Greyiaceae*
 family *Ledocarpaceae*
 family *Melianthaceae*
 family *Vivianiaceae*
 ❖ clade eurosids I
 family *Celastraceae*
 family *Huaceae*
 family *Parnassiaceae* (+ family *Lepuropetalaceae*)
 family *Stackhousiaceae*
 order *Cucurbitales*
 family *Anisophylleaceae*
 family *Begoniaceae*
 family *Coriariaceae*
 family *Corynocarpaceae*
 family *Cucurbitaceae*
 family *Datiscaceae*
 family *Tetramelaceae*
 order *Fabales*
 family *Fabaceae*
 family *Polygalaceae*
 family *Quillajaceae*
 family *Surianaceae*
 order *Fagales*
 family *Betulaceae*
 family *Casuarinaceae*
 family *Fagaceae*
 family *Juglandaceae*
 family *Myricaceae*
 family *Nothofagaceae*
 family *Rhoipteleaceae*
 family *Ticodendraceae*
 order *Malpighiales*
 family *Achariaceae*
 family *Balanopaceae*
 family *Caryocaraceae*
 family *Chrysobalanaceae*
 family *Clusiaceae*
 family *Dichapetalaceae*
 family *Erythroxylaceae*
 family *Euphorbiaceae*
 family *Euphroniaceae*
 family *Flacourtiaceae*
 family *Goupiaceae*
 family *Hugoniaceae*
 family *Humiriaceae*
 family *Hypericaceae*
 family *Irvingiaceae*

family *Ixonanthaceae*
 family *Lacistemaceae*
 family *Linaceae*
 family *Malesherbiaceae*
 family *Malpighiaceae*
 family *Medusagynaceae*
 family *Ochnaceae*
 family *Pandaceae*
 family *Passifloraceae*
 family *Putranjivaceae*
 family *Quiinaceae*
 family *Rhizophoraceae*
 family *Salicaceae*
 family *Scyphostegiaceae*
 family *Trigoniaceae*
 family *Turneraceae*
 family *Violaceae*
 order *Oxalidales*
 family *Cephalotaceae*
 family *Connaraceae*
 family *Cunoniaceae*
 family *Elaeocarpaceae*
 family *Oxalidaceae*
 family *Tremandraceae*
 order *Rosales*
 family *Barbeyaceae*
 family *Cannabaceae*
 family *Cecropiaceae*
 family *Celtidaceae*
 family *Dirachmaceae*
 family *Elaeagnaceae*
 family *Moraceae*
 family *Rhamnaceae*
 family *Rosaceae*
 family *Ulmaceae*
 family *Urticaceae*
 ❖ clade eurosids II
 family *Tapisciaceae*
 order *Brassicales*
 family *Akaniaceae* (+ family *Bretschneideriaceae*)
 family *Bataceae*
 family *Brassicaceae*
 family *Caricaceae*
 family *Emblingiaceae*
 family *Gyrostemonaceae*
 family *Koerberliniaceae*
 family *Limnanthaceae*
 family *Moringaceae*
 family *Pentadiplandraceae*
 family *Resedaceae*
 family *Salvadoraceae*

family *Setchellanthaceae*
 family *Tovariaceae*
 family *Tropaeolaceae*
 order *Malvales*
 family *Bixaceae* (+ family *Diegodendraceae*)
 family *Cistaceae*
 family *Cochlospermaceae*
 family *Dipterocarpaceae*
 family *Malvaceae*
 family *Muntingiaceae*
 family *Neuradaceae*
 family *Sarcolaenaceae*
 family *Sphaerosepalaceae*
 family *Thymelaeaceae*
 order *Myrtales*
 family *Alzateaceae*
 family *Combretaceae*
 family *Crypteroniaceae*
 family *Heteropyxidaceae*
 family *Lythraceae*
 family *Melastomataceae*
 family *Memecylaceae*
 family *Myrtaceae*
 family *Oliniaceae*
 family *Onagraceae*
 family *Penaeaceae*
 family *Psiloxylaceae*
 family *Rhynchocalycaceae*
 family *Vochysiaceae*
 order *Sapindales*
 family *Anacardiaceae*
 family *Biebersteiniaceae*
 family *Burseraceae*
 family *Kirkiaceae*
 family *Meliaceae*
 family *Nitrariaceae* (+ family *Peganaceae*)
 family *Rutaceae*
 family *Sapindaceae*
 family *Simaroubaceae*
 ➤ clade asterids
 order *Cornales*
 family *Cornaceae* (+ family *Nyssaceae*)
 family *Grubbiaceae*
 family *Hydrangeaceae*
 family *Hydrostachyaceae*
 family *Loasaceae*
 order *Ericales*
 family *Actinidiaceae*
 family *Balsaminaceae*
 family *Clethraceae*
 family *Cyrillaceae*

family *Diapensiaceae*
family *Ebenaceae*
family *Ericaceae*
family *Fouquieriaceae*
family *Halesiaceae*
family *Lecythidaceae*
family *Marcgraviaceae*
family *Myrsinaceae*
family *Pellicieraceae*
family *Polemoniaceae*
family *Primulaceae*
family *Roridulaceae*
family *Sapotaceae*
family *Sarraceniaceae*
family *Styracaceae*
family *Symplocaceae*
family *Ternstroemiaceae*
family *Tetrameristaceae*
family *Theaceae*
family *Theophrastaceae*
❖ clade euasterids I
family *Boraginaceae*
family *Plocospermataceae*
family *Vahliaceae*
order *Garryales*
family *Aucubaceae*
family *Eucommiaceae*
family *Garryaceae*
family *Oncothecaceae*
order *Gentianales*
family *Apocynaceae*
family *Gelsemiaceae*
family *Gentianaceae*
family *Loganiaceae*
family *Rubiaceae*
order *Lamiales*
family *Acanthaceae*
family *Avicenniaceae*
family *Bignoniaceae*
family *Buddlejaceae*
family *Byblidaceae*
family *Cyclocheilaceae*
family *Gesneriaceae*
family *Lamiaceae*
family *Lentibulariaceae*
family *Myoporaceae*
family *Oleaceae*
family *Paulowniaceae*
family *Pedaliaceae* (+ family *Martyniaceae*)
family *Phrymaceae*
family *Plantaginaceae*

family *Schlegeliaceae*
 family *Scrophulariaceae*
 family *Stilbaceae*
 family *Tetrachondraceae*
 family *Verbenaceae*
 order *Solanales*
 family *Convolvulaceae*
 family *Hydroleaceae*
 family *Montiniaceae*
 family *Solanaceae*
 family *Spenocleaceae*
 ❖ clade euasterids II
 family *Adoxaceae*
 family *Bruniaceae*
 family *Carlemanniaceae*
 family *Columelliaceae* (+ family *Desfontainiaceae*)
 family *Eremosynaceae*
 family *Escalloniaceae*
 family *Icacinaceae*
 family *Polyosmaceae*
 family *Sphenostemonaceae*
 family *Tribelaceae*
 order *Apiales*
 family *Apiaceae*
 family *Araliaceae*
 family *Aralidiaceae*
 family *Griselinaceae*
 family *Melanophyllaceae*
 family *Pittosporaceae*
 family *Toricelliaceae*
 order *Aquifoliales*
 family *Aquifoliaceae*
 family *Helwingiaceae*
 family *Phyllonomaceae*
 order *Asterales*
 family *Alseuosmiaceae*
 family *Argyrophyllaceae*
 family *Asteraceae*
 family *Calyceraceae*
 family *Campanulaceae* (+ family *Lobeliaceae*)
 family *Carpodetaceae*
 family *Donatiaceae*
 family *Goodeniaceae*
 family *Menyanthaceae*
 family *Pentaphragmataceae*
 family *Phellinaceae*
 family *Rousseaceae*
 family *Stylidiaceae*
 order *Dipsacales*
 family *Caprifoliaceae*
 family *Diervillaceae*

family *Dipsacaceae*
family *Linnaeaceae*
family *Morinaceae*
family *Valerianaceae*

"+ ..." = optional segregate family, that may be split off from the preceding family.

❖ **Families of uncertain position**

family *Balanophoraceae*
family *Bonnetiaceae*
family *Cardiopteridaceae*
family *Ctenolophonaceae*
family *Cynomoriaceae*
family *Cytinaceae*
family *Dipentodontaceae*
family *Elatinaceae*
family *Geissolomataceae*
family *Hoplestigmataceae*
family *Kaliphoraceae*
family *Lepidobotryaceae*
family *Lissocarpaceae*
family *Lophopyxidaceae*
family *Medusandraceae*
family *Mettenusiaceae*
family *Mitrastemonaceae*
family *Paracryphiaceae*
family *Pentaphylacaceae*
family *Peridiscaceae*
family *Plagiopteraceae*
family *Pottingeriaceae*
family *Sladeniaceae*
family *Strasburgeriaceae*
family *Tepuianthaceae*

APG II system

The second paper published by the APG presents an update to the original classification of 1998.

The authors say that changes have been proposed only when there is "substantial new evidence" which supports them.

The proposed classification continues the tradition of seeking broad circumscriptions of taxa, for example trying to place small families containing only one genus in a larger group.

The authors say that they have generally accepted the views of specialists, although noting that specialists "nearly always favour splitting of groups" regarded as too varied in their morphology.

APG II continues and indeed extends the use of alternative "bracketed" taxa allowing the choice of either a large family or a number of smaller ones.

For example, the large *Asparagaceae* family includes 7 “bracketed” families which can either be considered as part of the *Asparagaceae* or as separate families.

Some of the main changes in APG II are:

- New orders are proposed, particularly to accommodate the 'basal clades' left as families in the first system.
- Many of the previously unplaced families are now located within the system.
- Several major families are re-structured.

In 2007, a paper was published giving a linear ordering of the families in APG II, suitable for ordering herbarium specimens, for exampl.

The APG II system (2003) of plant classification is the second, now obsolete, version of a modern, mostly molecular-based, system of plant taxonomy that was published in April of 2003 by the Angiosperm Phylogeny Group.

It was a revision of the first APG system, published in 1998, and was superseded in 2009 by a further revision, the APG III system. APG II was published as:

- Angiosperm Phylogeny Group (2003). "An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II". *Botanical Journal of the Linnean Society* 141(4): 399-436.

Each of the APG systems represents the broad consensus of a number of systematic botanists, united in the APG, working at several institutions worldwide.

The APG II system recognized 45 orders, five more than the APG system.

The new orders were *Austrobaileyales*, *Canellales*, *Gunnerales*, *Celastrales*, and *Crossosomatales*, all of which were families unplaced as to order, although contained in supra-ordinal clades, in the APG system.

APG II recognized 457 families, five fewer than the APG system. Thirty-nine of the APG II families were not placed in any order, but 36 of the 39 were placed in a supra-ordinal clade within the angiosperms.

Fifty-five of the families came to be known as "bracketed families".

They were optional segregates of families that could be circumscribed in a larger sense.

The APG II system was influential and was adopted in whole or in part (sometimes with modifications) in a number of references. It was superseded 6½ years later by the APG III system, published in October of 2009.

Main groups in the system (all unranked clades between the ranks of class and order):

- angiosperms :
 - magnoliids
 - monocots
 - commelinids
 - eudicots
 - core eudicots
 - rosids
 - ❖ eurosids I
 - ❖ eurosids II
 - asterids
 - ❖ euasterids I
 - ❖ euasterids II

Shown below is the classification in full detail, except for the fifteen genera and three families that were unplaced in APG II.

The unplaced taxa were listed at the end of the appendix in a section entitled "Taxa of Uncertain Position".

Under some of the clades are listed the families that were placed *incertae sedis* in that clade. Thirty-six families were so placed. This means that their relationship to other members of the clade is not known.

- paraphyletic grade basal angiosperms
 - family *Amborellaceae*
 - family *Chloranthaceae*
 - family *Nymphaeaceae* (+ family *Cabombaceae*)
 - order *Austrobaileyales*
 - order *Ceratophyllales*
- clade magnoliids
 - order *Canellales*
 - order *Laurales*
 - order *Magnoliales*
 - order *Piperales*
- clade monocots
 - family *Petrosaviaceae*
 - order *Acorales*
 - order *Alismatales*
 - order *Asparagales*
 - order *Dioscoreales*
 - order *Liliales*
 - order *Pandanales*
- clade commelinids
 - family *Dasygongonaceae*
 - order *Arecales*
 - order *Commelinales*
 - order *Poales*
 - order *Zingiberales*
- clade eudicots
 - family *Buxaceae* (+ family *Didymelaceae*)
 - family *Sabiaceae*
 - family *Trochodendraceae* (+ family *Tetracentraceae*)
 - order *Proteales*
 - order *Ranunculales*
- clade core eudicots
 - family *Aextoxicaceae*
 - family *Berberidopsidaceae*
 - family *Dilleniaceae*
 - order *Gunnerales*
 - order *Caryophyllales*
 - order *Santalales*
 - order *Saxifragales*
- clade rosids
 - family *Aphloiaceae*
 - family *Geissolomataceae*
 - family *Ixerbaceae*
 - family *Picramniaceae*
 - family *Strasburgeriaceae*
 - family *Vitaceae*
 - order *Crossosomatales*
 - order *Geraniales*

order *Myrtales*

❖ clade eurosids I

family *Zygophyllaceae* (+ family *Krameriaceae*)

family *Huaceae*

order *Celastrales*

order *Cucurbitales*

order *Fabales*

order *Fagales*

order *Malpighiales*

order *Oxalidales*

order *Rosales*

❖ clade eurosids II

family *Tapisciaceae*

order *Brassicales*

order *Malvales*

order *Sapindales*

➤ clade asterids

order *Cornales*

order *Ericales*

❖ clade euasterids I

family *Boraginaceae*

family *Icacinaceae*

family *Oncothecaceae*

family *Vahliaceae*

order *Garryales*

order *Gentianales*

order *Lamiales*

order *Solanales*

❖ clade euasterids II

family *Bruniaceae*

family *Columelliaceae* (+ family *Desfontainiaceae*)

family *Eremosynaceae*

family *Escalloniaceae*

family *Paracryphiaceae*

family *Polyosmaceae*

family *Sphenostemonaceae*

family *Tribelaceae*

order *Apiales*

order *Aquifoliales*

order *Asterales*

order *Dipsacales*

"+ ..." = optionally separate family, that may be split off from the preceding family.

In figure 1 are reported the Cladogram of Angiosperms.

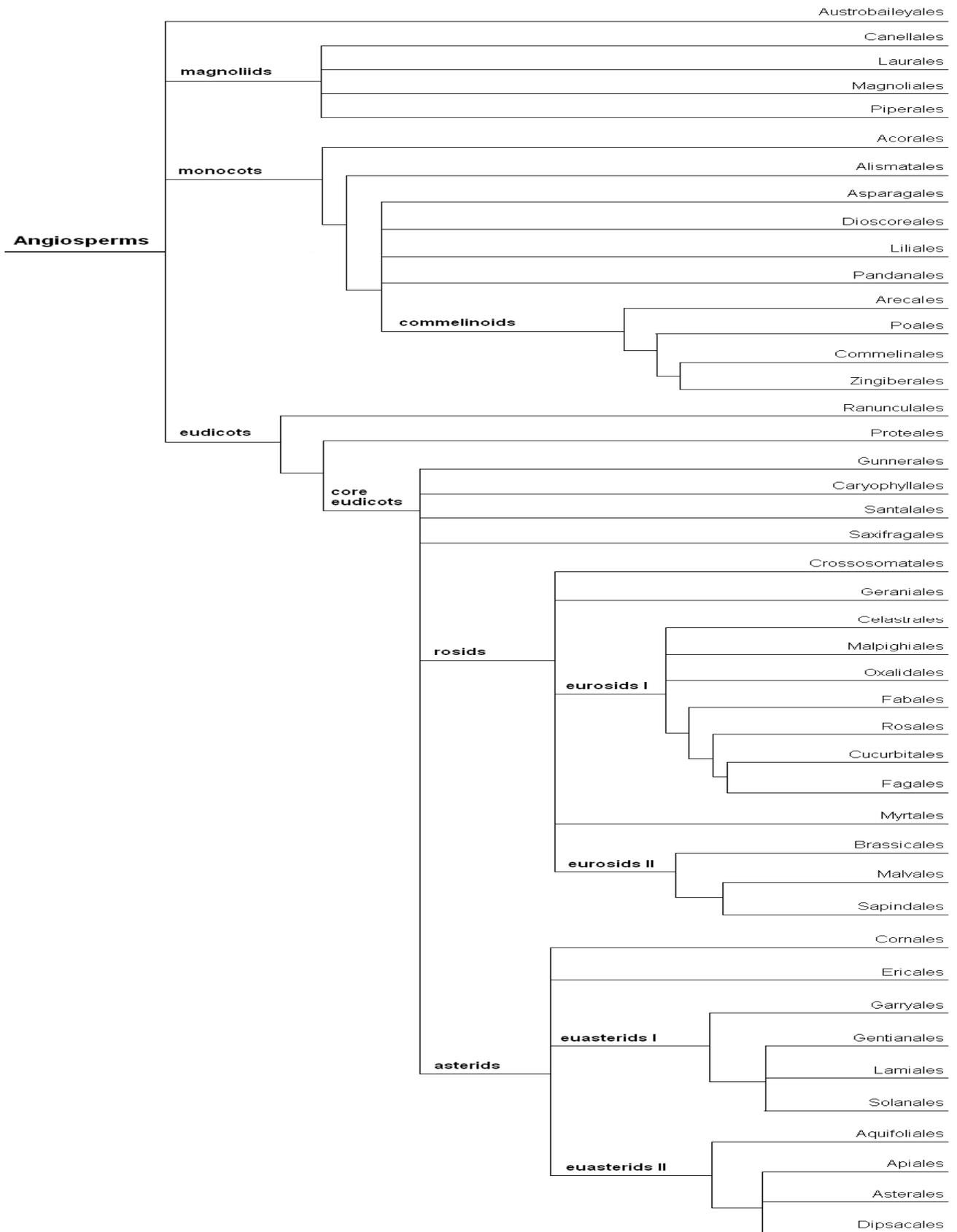


Figure 1 - A cladogram showing the relationships, but excluding taxa not placed within an order.

APG III system

The third paper from the APG updates the system described in the 2003 paper. The broad outline of the system remains unchanged, but the number of previously unplaced families and genera is significantly reduced. This requires the recognition of both new orders and new families compared to the previous classification. The number of orders goes up from 45 to 59; only 10 families are not placed in an order and only two of these (*Apodanthaceae* and *Cynomoriaceae*) are left entirely outside the classification. The authors say that they have tried to leave long-recognized families unchanged, while merging families with few genera. They "hope the classification will not need much further change."

A major change is that the paper discontinues the use of 'bracketed' families in favour of larger, more inclusive families. As a result, the APG III system contains only 415 families, rather than the 457 of APG II. For example, the agave family (*Agavaceae*) and the hyacinth family (*Hyacinthaceae*) are no longer regarded as distinct from the broader asparagus family (*Asparagaceae*). The authors say that alternative circumscriptions, as in APG I and II, are likely to cause confusion and that major herbaria which are re-arranging their collections in accordance with the APG approach have all agreed to use the more inclusive families. In the same volume of the journal, two related papers were published. One gives a linear ordering of the families in APG III; as with the linear ordering published for APG II, this is intended for ordering herbarium specimens, for example. The other paper gives, for the first time, a classification of the families in APG III which uses formal taxonomic ranks; previously only informal clade names were used above the ordinal level.

The APG III system (2009) of plant classification is the third version of a modern, mostly molecular-based, system of plant taxonomy that was published in 2009 by the Angiosperm Phylogeny Group, 6½ years after its predecessor, the APG II system was published. In October 2009, members of the Linnean Society proposed an accompanying formal phylogenetic classification of all land plants, compatible with the APG III classification.[4] This was needed because botanists and phycologists often disagree on the taxonomic rank to which groups are assigned. The APG III system recognized all of the 45 orders of the previous system, as well as 14 new ones. The order Ceratophyllales was erroneously marked as a new order, but it had been recognized in both of the previous APG systems. The newly recognized orders were: *Amborellales*, *Nymphaeales*, *Chloranthales*, *Petrosaviales*, *Trochodendrales*, *Buxales*, *Vitales*, *Zygophyllales*, *Picramniales*, *Huerteales*, *Berberidopsidales*, *Escalloniales*, *Bruniales*, and *Paracryphiales*.

The designation of alternative "bracketed families" was abandoned in APG III, because its inclusion in the previous system had been unpopular. APG III recognized 415 families, 42 fewer than in the previous system. Forty-four of the 55 "bracketed families" were discontinued, and 18 other families were discontinued as well.

The discontinued bracketed families were:

Illiciaceae, *Alliaceae*, *Agapanthaceae*, *Agavaceae*, *Aphyllanthaceae*, *Hesperocallidaceae*, *Hyacinthaceae*, *Laxmanniaceae*, *Ruscaceae*, *Themidaceae*, *Asphodelaceae*, *Hemerocallidaceae*, *Kingdoniaceae*, *Fumariaceae*, *Pteridophyllaceae*, *Didymelaceae*, *Tetracentraceae*, *Pterostemonaceae*, *Hypseocharitaceae*, *Francoaceae*, *Memecylaceae*, *Lepuropetalaceae*, *Rhoipteleaceae*, *Medusagynaceae*, *Quiinaceae*, *Malesherbiaceae*, *Turneraceae*, *Bretschneideraceae*, *Diegodendraceae*, *Cochlospermaceae*, *Peganaceae*, *Tetradiclidaceae*, *Nyssaceae*, *Ternstroemiaceae*, *Pellicieraceae*, *Aucubaceae*, *Donatiaceae*, *Lobeliaceae*, *Desfontainiaceae*, *Diervillaceae*, *Dipsacaceae*, *Linnaeaceae*, *Morinaceae*, and *Valerianaceae*.

The other discontinued families were:

Limnocharitaceae, Luzuriagaceae, Sparganiaceae, Ledocarpaceae, Heteropyxidaceae, Psiloxylaceae, Oliniaceae, Rhynchocalycaceae, Parnassiaceae, Maesaceae, Myrsinaceae, Theophrastaceae, Eremosynaceae, Polyosmaceae, Tribelaceae, Aralidiaceae, Mackinlayaceae, and Melanophyllaceae.

20 families were accepted in the APG III system which had not been in the previous system, and a few families were moved to a different position. The newly recognized families are:

Petermanniaceae, Schoepfiaceae, Limeaceae, Lophiocarpaceae, Montiaceae, Talinaceae, Anacampserotaceae, Centroplocaceae, Calophyllaceae, Guamatelaceae, Gerrardinaceae, Dipentodontaceae, Cappariaceae, Cleomaceae, Cytinaceae, Mitrastemonaceae, Metteniusaceae, Linderniaceae, Thomandersiaceae, and Quintiniaceae.

The number of families not placed in any order was reduced from 39 to 10. *Apodanthaceae* and *Cynomoriaceae* were placed among the angiosperms, incertae sedis, that is, not in any group within the angiosperms. Eight other families were placed incertae sedis in various supra-ordinal groups within the angiosperms. The unplaced families were:

Apodanthaceae, Cynomoriaceae, Dasypogonaceae, Sabiaceae, Dilleniaceae, Icacinaceae, Metteniusaceae, Oncothecaceae, Vahliaceae, and Boraginaceae.

The circumscription of the family *Icacinaceae* remains especially doubtful. *Apodytes, Emmotum, Cassinopsis*, and a few other genera were provisionally retained within it until further studies can determine whether they properly belong there.

Three genera (*Gumillea, Nicobariodendron, and Petenaea*) were placed within the angiosperms incertae sedis. *Gumillea* had been unplaced in APG II. *Nicobariodendron* and *Petenaea* were newly added to the list.

The classification is shown below in two versions. The short version goes to the level of orders and of families unplaced in an order. The detailed version shows all the families. Orders at the same level in the classification are arranged alphabetically. Note that orders may not contain the same families as in earlier versions of the APG system (APG system, APG II system). Further detail on relationships can be seen in the phylogenetic tree below.

Short version

- clade angiosperms
 - order *Amborellales*
 - order *Nymphaeales*
 - order *Austrobaileyales*
 - order *Chloranthales*
 - clade magnoliids
 - order *Canellales*
 - order *Laurales*
 - order *Magnoliales*
 - order *Piperales*
 - clade monocots
 - order *Acorales*
 - order *Alismatales*
 - order *Asparagales*
 - order *Dioscoreales*
 - order *Liliales*
 - order *Pandanales*
 - order *Petrosaviales*
 - clade commelinids
 - family *Dasypogonaceae* -- unplaced in an order
 - order *Arecales*
 - order *Commelinales*
 - order *Poales*

- order *Zingiberales*
- probable sister of eudicots
 - order *Ceratophyllales*
- clade eudicots
 - family *Sabiaceae* -- unplaced in an order
 - order *Buxales*
 - order *Proteales*
 - order *Ranunculales*
 - order *Trochodendrales*
- clade core eudicots
 - family *Dilleniaceae* -- unplaced in an order
 - order *Gunnerales*
 - order *Saxifragales*
- clade rosids
 - order *Vitales*
 - ❖ clade fabids (eurosids I)
 - order *Celastrales*
 - order *Cucurbitales*
 - order *Fabales*
 - order *Fagales*
 - order *Malpighiales*
 - order *Oxalidales*
 - order *Rosales*
 - order *Zygophyllales*
 - ❖ clade malvids (eurosids II)
 - order *Brassicales*
 - order *Crossosomatales*
 - order *Geraniales*
 - order *Huerteales*
 - order *Malvales*
 - order *Myrtales*
 - order *Picramniales*
 - order *Sapindales*

(back to core eudicots)

- order *Berberidopsidales*
- order *Caryophyllales*
- order *Santalales*
- clade asterids
 - order *Cornales*
 - order *Ericales*
 - ❖ clade lamiids (euasterids I)
 - family *Boraginaceae* -- unplaced in an order
 - family *Vahliaceae* -- unplaced in an order
 - family *Icacinaceae* -- unplaced in an order
 - family *Metteniusaceae* -- unplaced in an order
 - family *Oncothecaceae* -- unplaced in an order
 - order *Garryales*
 - order *Gentianales*
 - order *Lamiales*
 - order *Solanales*

- ❖ clade campanulids (euasterids II)
 - order *Apiales*
 - order *Aquifoliales*
 - order *Asterales*
 - order *Bruniales*
 - order *Dipsacales*
 - order *Escalloniales*
 - order *Paracryphiales*

Detailed version (with all families)

Legend:

* = new family placement;

† = newly recognized order for the APG system;

§ = new family circumscription described in the text;

\$ = families that represent the broader circumscription of options available in APG II and favoured here;

\$\$ = families that were in square brackets in APG II, the narrower circumscriptions favoured here.

Angiosperms

- †*Amborellales* Melikyan, A.V.Bobrov & Zaytzeva
 - *Amborellaceae* Pichon
- †*Nymphaeales* Salisb. ex Bercht. & J.Presl
 - \$\$*Cabombaceae* Rich. ex A.Rich.
 - **Hydatellaceae* U.Hamann
 - \$\$*Nymphaeaceae* Salisb.
- *Austrobaileyales* Takht. ex Reveal
 - *Austrobaileyaceae* Croizat
 - \$\$*Schisandraceae* Blume (including *Illiciaceae* A.C.Sm.)
 - *Trimeniaceae* L.S.Gibbs
- †*Chloranthales* R.Br.
 - *Chloranthaceae* R.Br. ex Sims

Magnoliids

- *Canellales* Cronquist
 - *Canellaceae* Mart.
 - *Winteraceae* R.Br. ex Lindl.
- *Piperales* Bercht. & J.Presl
 - *Aristolochiaceae* Juss.
 - *Hydnoraceae* C.Agardh
 - *Lactoridaceae* Engl.
 - *Piperaceae* Giseke
 - *Saururaceae* F.Voigt
- *Laurales* Juss. ex Bercht. & J.Presl
 - *Atherospermataceae* R.Br.
 - *Calycanthaceae* Lindl.
 - *Gomortegaceae* Reiche
 - *Hernandiaceae* Blume
 - *Lauraceae* Juss.
 - *Monimiaceae* Juss.
 - *Siparunaceae* Schodde
- *Magnoliales* Juss. ex Bercht. & J.Presl
 - *Annonaceae* Juss.

- *Degeneriaceae* I.W.Bailey & A.C.Sm.
- *Eupomatiaceae* Orb.
- *Himantandraceae* Diels
- *Magnoliaceae* Juss.
- *Myristicaceae* R.Br.

Monocots

- *Acorales* Link
 - *Acoraceae* Martinov
- *Alismatales* R.Br. ex Bercht. & J.Presl
 - §*Alismataceae* Vent. (including *Limnocharitaceae* Takht. ex Cronquist)
 - *Aponogetonaceae* Planch.
 - *Araceae* Juss.
 - *Butomaceae* Mirb.
 - *Cymodoceaceae* Vines
 - *Hydrocharitaceae* Juss.
 - *Juncaginaceae* Rich.
 - *Posidoniaceae* Vines
 - *Potamogetonaceae* Bercht. & J.Presl
 - *Ruppiaceae* Horan.
 - *Scheuchzeriaceae* F.Rudolphi
 - *Tofieldiaceae* Takht.
 - *Zosteraceae* Dumort.
- †*Petrosaviales* Takht.
 - *Petrosaviaceae* Hutch.
- *Dioscoreales* R.Br.
 - *Burmanniaceae* Blume
 - *Dioscoreaceae* R.Br.
 - *Nartheciaceae* Fr. ex Bjurzon
- *Pandanales* R.Br. ex Bercht. & J.Presl
 - *Cyclanthaceae* Poit. ex A.Rich.
 - *Pandanaceae* R.Br.
 - *Stemonaceae* Caruel
 - *Triuridaceae* Gardner
 - *Velloziaceae* J.Agardh
- *Liliales* Perleb
 - §*Alstroemeriaceae* Dumort. (including *Luzuriagaceae* Lotsy)
 - *Campynemataceae* Dumort.
 - *Colchicaceae* DC.
 - *Corsiaceae* Becc.
 - *Liliaceae* Juss.
 - *Melanthiaceae* Batsch ex Borkh.
 - **Petermanniaceae* Hutch.
 - *Philesiaceae* Dumort.
 - *Ripogonaceae* Conran & Clifford
 - *Smilacaceae* Vent.
- *Asparagales* Link
 - §*Amaryllidaceae* J.St.-Hil. (including *Agapanthaceae* F.Voigt, *Alliaceae* Borkh.)
 - §*Asparagaceae* Juss. (including *Agavaceae* Dumort., *Aphyllanthaceae* Burnett, *Hesperocallidaceae* Traub, *Hyacinthaceae* Batsch ex Borkh., *Laxmanniaceae* Bubani, *Ruscaceae* M.Roem., *Themidaceae* Salisb.)

- *Asteliaceae* Dumort.
- *Blandfordiaceae* R.Dahlgren & Clifford
- *Boryaceae* M.W.Chase, Rudall & Conran
- *Doryanthaceae* R.Dahlgren & Clifford
- *Hypoxidaceae* R.Br.
- *Iridaceae* Juss.
- *Ixioliriaceae* Nakai
- *Lanariaceae* R.Dahlgren & A.E.van Wyk
- *Orchidaceae* Juss.
- *Tecophilaeaceae* Leyb. §*Xanthorrhoeaceae* Dumort. (including *Asphodelaceae* Juss. and *Hemerocallidaceae* R.Br.)
- *Xeronemataceae* M.W.Chase, Rudall & M.F.Fay

Commelinids

- *Dasypogonaceae* Dumort.
- *Arecales* Bromhead
 - *Arecaceae* Bercht. & J.Presl
- *Commelinales* Mirb. ex Bercht. & J.Presl
 - *Commelinaceae* Mirb.
 - *Haemodoraceae* R. Br.
 - *Hanguanaceae* Airy Shaw
 - *Philydraceae* Link
 - *Pontederiaceae* Kunth
- *Poales* Small
 - *Anarthriaceae* D.F.Cutler & Airy Shaw
 - *Bromeliaceae* Juss.
 - *Centrolepidaceae* Endl.
 - *Cyperaceae* Juss.
 - *Ecdeiocoleaceae* D.F.Cutler & Airy Shaw
 - *Erocaulaceae* Martin v
 - *Flagellariaceae* Dumort.
 - *Joinvilleaceae* Toml. & A.C.Sm.
 - *Juncaceae* Juss.
 - *Mayacaceae* Kunth
 - *Poaceae* Barnhart
 - *Rapateaceae* Dumort.
 - *Restionaceae* R.Br.
 - *Thurniaceae* Engl.
 - §*Typhaceae* Juss. (including *Sparganiaceae* Hanin)
 - *Xyridaceae* C.Agardh
- *Zingiberales* Griseb.
 - *Cannaceae* Juss.
 - *Costaceae* Nakai
 - *Heliconiaceae* Vines
 - *Lowiaceae* Ridl.
 - *Marantaceae* R.Br.
 - *Musaceae* Juss.
 - *Strelitziaceae* Hutch.
 - *Zingiberaceae* Martinov

Probable sister of eudicots

- *Ceratophyllales* Link
 - *Ceratophyllaceae* Gray

Eudicots

- *Ranunculales* Juss. ex Bercht. & J.Presl
 - *Berberidaceae* Juss.
 - *Circaeasteraceae* Hutch. (including *Kingdoniaceae* Airy Shaw)
 - *Eupteleaceae* K.Wilh.
 - *Lardizabalaceae* R.Br.
 - *Menispermaceae* Juss.
 - *Papaveraceae* Juss. (including *Fumariaceae* Marquis, *Pteridophyllaceae* Nakai ex Reveal & Hoogland)
 - *Ranunculaceae* Juss.
- *Sabiaceae* Blume
- *Proteales* Juss. ex Bercht. & J.Presl
 - *Nelumbonaceae* A.Rich.
 - *Platanaceae* T.Lestib.
 - *Proteaceae* Juss.
- †*Trochodendrales* Takht. ex Cronquist
 - *Trochodendraceae* Eichler (including *Tetracentraceae* A.C.Sm.)
- †*Buxales* Takht. ex Reveal
 - *Buxaceae* Dumort. (including *Didymelaceae* Leandri)

Core eudicots

- *Gunnerales* Takht. ex Reveal
 - *Gunneraceae* Meisn.
 - *Myrothamnaceae* Nied.
- *Dilleniaceae* Salisb.
- *Saxifragales* Bercht. & J.Presl
 - *Altingiaceae* Horan.
 - *Aphanopetalaceae* Doweld
 - *Cercidiphyllaceae* Engl.
 - *Crassulaceae* J.St.-Hil.
 - *Daphniphyllaceae* Müll.-Arg.
 - *Grossulariaceae* DC.
 - *Haloragaceae* R.Br.
 - *Hamamelidaceae* R.Br.
 - *Iteaceae* J.Agardh (including *Pterostemonaceae* Small)
 - *Paeoniaceae* Raf.
 - *Penthoraceae* Rydb. ex Britt.
 - *Peridiscaceae* Kuhlm. (including *Medusandraceae* Brenan, *Soyauxia* Oliver)
 - *Saxifragaceae* Juss.
 - *Tetracarpaeaceae* Nakai
- †*Berberidopsidales* Doweld
 - *Aextoxicaceae* Engl. & Gilg
 - *Berberidopsidaceae* Takht.
- *Santalales* R.Br. ex Bercht. & J.Presl
 - *Balanophoraceae* Rich.
 - *Loranthaceae* Juss.
 - *Misodendraceae* J.Agardh
 - *Santalaceae* R.Br.

- *Olacaceae* R.Br.
- *Opiliaceae* Valetton
- **Schoepfiaceae* Blume
- *Caryophyllales* Juss. ex Bercht. & J.Presl
 - *Achatocarpaceae* Heimerl
 - *Aizoaceae* Martinov
 - *Amaranthaceae* Juss.
 - **Anacampserotaceae* Eggli & Nyffeler
 - *Ancistrocladaceae* Planch. ex Walp.
 - *Asteropeiaceae* Takht. ex Reveal & Hoogland
 - *Barbeuiaceae* Nakai
 - *Basellaceae* Raf.
 - *Cactaceae* Juss.
 - *Caryophyllaceae* Juss.
 - *§Didiereaceae* Radlk.
 - *Dioncophyllaceae* Airy Shaw
 - *Droseraceae* Salisb.
 - *Drosophyllaceae* Chrtek, Slavíková & Studnicka
 - *Frankeniaceae* Desv.
 - *Gisekiaceae* Nakai
 - *Halophytaceae* A.Soriano
 - **Limeaceae* Shipunov ex Reveal
 - **Lophiocarpaceae* Doweld & Reveal
 - *§Molluginaceae* Bartl.
 - **Montiaceae* Raf.
 - *Nepenthaceae* Dumort.
 - *Nyctaginaceae* Juss.
 - *Physenaceae* Takht.
 - *Phytolaccaceae* R.Br.
 - *Plumbaginaceae* Juss.
 - *Polygonaceae* Juss.
 - *§Portulacaceae* Juss.
 - *Rhabdodendraceae* Prance
 - *Sarcobataceae* Behnke
 - *Simmondsiaceae* Tiegh.
 - *Stegnospemataceae* Nakai
 - **Talinaceae* Doweld
 - *Tamaricaceae* Link

Rosids

- †*Vitales* Juss. ex Bercht. & J.Presl
 - *Vitaceae* Juss.

Eurosids I

- †*Zygophyllales* Link
 - *§§Krameriaceae* Dumort.
 - *§§Zygophyllaceae* R.Br.
- *Celastrales* Link
 - *§Celastraceae* R.Br. (including *Lepuropetalaceae* Nakai, *Parnassiaceae* Martinov, *Pottingeriaceae* Takht.)
 - *Lepidobotryaceae* J.Léonard

- *Oxalidales* Bercht. & J.Presl
 - *Brunelliaceae* Engl.
 - *Cephalotaceae* Dumort.
 - *Connaraceae* R.Br.
 - *Cunoniaceae* R.Br.
 - *Elaeocarpaceae* Juss. ex DC.
 - **Huaceae* A.Chev.
 - *Oxalidaceae* R.Br.
- *Malpighiales* Juss. ex Bercht. & J.Presl
 - *Achariaceae* Harms
 - *Balanopaceae* Benth. & Hook.f.
 - *Bonnetiaceae* L.Beauvis. ex Nakai
 - **Calophyllaceae* J.Agardh
 - *Caryocaraceae* Voigt
 - **Centropalacaceae* Doweld & Reveal
 - \$\$*Chrysobalanaceae* R.Br.
 - §*Clusiaceae* Lindl.
 - *Ctenolophonaceae* Exell & Mendonça
 - \$\$*Dichapetalaceae* Baill.
 - *Elatinaceae* Dumort.
 - \$\$\$*Erythroxylaceae* Kunth (including *Aneulophus* Benth.)
 - *Euphorbiaceae* Juss.
 - \$\$*Euphroniaceae* Marc.-Berti
 - *Goupiaceae* Miers
 - *Humiriaceae* A.Juss.
 - *Hypericaceae* Juss.
 - *Irvingiaceae* Exell & Mendonça
 - *Ixonanthaceae* Planch. ex Miq.
 - *Lacistemataceae* Mart.
 - *Linaceae* DC. ex Perleb
 - *Lophopyxidaceae* H. Pfeiff.
 - *Malpighiaceae* Juss.
 - \$*Ochnaceae* DC. (including *Medusagynaceae* Engl. & Gilg, *Quiinaceae* Choisy)
 - *Pandaceae* Engl. & Gilg
 - \$*Passifloraceae* Juss. ex Roussel (including *Malesherbiaceae* D. Don, *Turneraceae* Kunth ex DC.)
 - *Phyllanthaceae* Martinov
 - *Picrodendraceae* Small
 - *Podostemaceae* Rich. ex Kunth
 - *Putranjivaceae* Meisn.
 - **Rafflesiaceae* Dumort.
 - \$\$*Rhizophoraceae* Pers.
 - *Salicaceae* Mirb.
 - \$\$*Trigoniaceae* A.Juss.
 - *Violaceae* Batsch
- *Cucurbitales* Juss. ex Bercht. & J.Presl
 - *Anisophylleaceae* Ridl.
 - *Begoniaceae* C.Agardh
 - *Coriariaceae* DC.
 - *Corynocarpaceae* Engl.
 - *Cucurbitaceae* Juss.

- *Datisceae* Dumort.
- *Tetramelaceae* Airy Shaw
- *Fabales* Bromhead
 - *Fabaceae* Lindl.
 - *Polygalaceae* Hoffmanns. & Link
 - *Quillajaceae* D.Don
 - *Surianaceae* Arn.
- *Fagales* Engl.
 - *Betulaceae* Gray
 - *Casuarinaceae* R.Br.
 - *Fagaceae* Dumort.
 - §*Juglandaceae* DC. ex Perleb (including *Rhoipteleaceae* Hand.-Mazz.)
 - *Myricaceae* A.Rich. ex Kunth
 - *Nothofagaceae* Kuprian
 - *Ticodendraceae* Gómez-Laur. & L.D.Gómez
- *Rosales* Bercht. & J.Presl
 - *Barbeyaceae* Rendle
 - *Cannabaceae* Martinov
 - *Dirachmaceae* Hutch.
 - *Elaeagnaceae* Juss.
 - *Moraceae* Gaudich.
 - *Rhamnaceae* Juss.
 - *Rosaceae* Juss.
 - *Ulmaceae* Mirb.
 - *Urticaceae* Juss.

Eurosids II

- *Geraniales* Juss. ex Bercht. & J.Presl
 - §*Geraniaceae* Juss. (including *Hypseocharitaceae* Wedd.)
 - §*Melianthaceae* Horan. (including *Francoaceae* A.Juss.)
 - §*Vivianiaceae* Klotzsch (including *Ledocarpaceae* Meyen)
- *Myrtales* Juss. ex Bercht. & J.Presl
 - *Alzateaceae* S.A.Graham
 - *Combretaceae* R.Br.
 - *Crypteroniaceae* A.DC.
 - *Lythraceae* J.St.-Hil.
 - §*Melastomataceae* Juss. (including *Memecylaceae* DC.)
 - §*Myrtaceae* Juss. (including *Heteropyxidaceae* Engl. & Gilg, *Psiloxylaceae* Croizat)
 - *Onagraceae* Juss.
 - §*Penaeaceae* Sweet ex Guill. (including *Oliniaceae* Arn., *Rhynchocalycaceae* L.A.S.Johnson & B.G.Briggs)
 - *Vochysiaceae* A.St.-Hil.
- *Crossosomatales* Takht. ex Reveal
 - **Aphloiaceae* Takht.
 - *Crossosomataceae* Engl.
 - **Geissolomataceae* A.DC.
 - **Guamatelaceae* S.Oh & D.Potter
 - *Stachyuraceae* J.Agardh
 - *Staphyleaceae* Martinov
 - *§*Strasburgeriaceae* Soler. (including *Ixerbaceae* Griseb. ex Doweld & Reveal)
- †*Picramniales* Doweld

- **Picramniaceae* Fernando & Quinn
- †*Huerteales* Doweld
 - **Dipentodontaceae* Merr.
 - **Gerrardinaceae* Alford
 - *Tapisciaceae* Takht.
- *Brassicales* Bromhead
 - \$*Akaniaceae* Stapf (including *Bretschneideraceae* Engl. & Gilg)
 - *Bataceae* Mart. ex Perleb
 - §*Brassicaceae* Burnett
 - **Capparaceae* Juss.
 - *Caricaceae* Dumort.
 - **Cleomaceae* Bercht. & J.Presl
 - *Emblingiaceae* J.Agardh
 - *Gyrostemonaceae* A.Juss.
 - *Koeberliniaceae* Engl.
 - *Limnanthaceae* R.Br.
 - *Moringaceae* Martinov
 - *Pentadiplandraceae* Hutch. & Dalziel
 - *Resedaceae* Martinov
 - *Salvadoraceae* Lindl.
 - *Setchellanthaceae* Iltis
 - *Tovariaceae* Pax
 - *Tropaeolaceae* Juss. ex DC.
- *Malvales* Juss. ex Bercht. & J.Presl
 - \$*Bixaceae* Kunth (including *Cochlospermaceae* Planch., *Diegodendraceae* Capuron)
 - *Cistaceae* Juss.
 - **Cytinaceae* A.Rich.
 - *Dipterocarpaceae* Blume
 - *Malvaceae* Juss.
 - *Muntingiaceae* C.Bayer, M.W.Chase & M.F.Fay
 - *Neuradaceae* Kostel.
 - *Sarcolaenaceae* Caruel
 - *Sphaerosepalaceae* Tiegh. ex Bullock
 - *Thymelaeaceae* Juss.
- *Sapindales* Juss. ex Bercht. & J.Presl
 - *Anacardiaceae* R.Br.
 - *Biebersteiniaceae* Schnizl.
 - *Burseraceae* Kunth
 - *Kirkiaceae* Takht.
 - *Meliaceae* Juss.
 - \$*Nitrariaceae* Lindl. (including *Peganaceae* Tiegh. ex Takht., *Tetradiclidaceae* Takht.)
 - *Rutaceae* Juss.
 - *Sapindaceae* Juss.
 - *Simaroubaceae* DC.

Asterids

- *Cornales* Link.
 - *Cornaceae* Bercht. & J.Presl (including *Nyssaceae* Juss. ex Dumort.)
 - *Curtisiaceae* Takht.
 - *Grubbiaceae* Endl. ex Meisn.

- *Hydrangeaceae* Dumort.
- *Hydrostachyaceae* Engl.
- *Loasaceae* Juss.
- *Ericales* Bercht. & J.Presl
 - *Actinidiaceae* Engl. & Gilg.
 - *Balsaminaceae* A.Rich.
 - *Clethraceae* Klotzsch
 - *Cyrillaceae* Lindl.
 - *Diapensiaceae* Lindl.
 - *Ebenaceae* Gürke
 - *Ericaceae* Juss.
 - *Fouquieriaceae* DC.
 - *Lecythidaceae* A.Rich.
 - *Marcgraviaceae* Bercht. & J.Presl
 - **Mitrastemonaceae* Makino
 - *§Pentaphylacaceae* Engl. (including *Ternstroemiaceae* Mirb. ex DC.)
 - *Polemoniaceae* Juss.
 - *§Primulaceae* Batsch ex Borkh. (including *Maesaceae* Anderb., B.Ståhl & Källersjö, *Myrsinaceae* R.Br., *Theophrastaceae* G.Don)
 - *Roridulaceae* Martinov
 - *Sapotaceae* Juss.
 - *Sarraceniaceae* Dumort.
 - *\$\$Sladeniaceae* Airy Shaw
 - *Styracaceae* DC. & Spreng.
 - *Symplocaceae* Desf.
 - *§Tetrameristaceae* Hutch. (including *Pellicieraceae* L.Beauvis.)
 - *Theaceae* Mirb. ex Ker Gawl.

Euasterids I

- *§*Boraginaceae* Juss. (including *Hoplestigmataceae* Gilg)
- *Vahliaceae* Dandy
- *Icacinaceae* Miers
- *Metteniusaceae* H.Karst. ex Schnizl.
- *Oncothecaceae* Kobuski ex Airy Shaw
- *Garryales* Lindl.
 - *Eucommiaceae* Engl.
 - *§Garryaceae* Lindl. (including *Aucubaceae* Bercht. & J.Presl)
- *Gentianales* Juss. ex Bercht. & J.Presl
 - *Apocynaceae* Juss.
 - *Gelsemiaceae* Struwe & V.A.Albert
 - *Gentianaceae* Juss.
 - *Loganiaceae* R.Br. ex Mart.
 - *Rubiaceae* Juss.
- *Lamiales* Bromhead
 - *§Acanthaceae* Juss.
 - *Bignoniaceae* Juss.
 - *Byblidaceae* Domin
 - *Calceolariaceae* Olmstead
 - *Carlemanniaceae* Airy Shaw
 - *Gesneriaceae* Rich. & Juss.
 - *Lamiaceae* Martinov

- **Linderniaceae* Borsch, K.Müll., & Eb.Fisch.
- *Lentibulariaceae* Rich.
- *Martyniaceae* Horan.
- *Oleaceae* Hoffmanns. & Link
- *Orobanchaceae* Vent.
- *Paulowniaceae* Nakai
- *Pedaliaceae* R.Br.
- *Phrymaceae* Schauer
- §*Plantaginaceae* Juss.
- *Plocospermataceae* Hutch.
- *Schlegeliaceae* Reveal
- *Scrophulariaceae* Juss.
- *Stilbaceae* Kunth
- *Tetrachondraceae* Wettst.
- **Thomandersiaceae* Sreem.
- *Verbenaceae* J.St.-Hil.
- *Solanales* Juss. ex Bercht. & J.Presl
 - *Convolvulaceae* Juss.
 - *Hydroleaceae* R.Br. ex Edwards
 - *Montiniaceae* Nakai
 - *Solanaceae* Juss.
 - *Sphenocleaceae* T.Baskerv.

Euasterids II

- *Aquifoliales* Senft
 - *Aquifoliaceae* Bercht. & J.Presl
 - §*Cardiopteridaceae* Blume (including *Leptaulaceae* Tiegh.)
 - *Helwingiaceae* Decne.
 - *Phyllonomaceae* Small
 - *Stemonuraceae* Kårehed
- *Asterales* Link
 - *Alseuosmiaceae* Airy Shaw
 - *Argophyllaceae* Takht.
 - *Asteraceae* Bercht. & J.Presl
 - *Calyceraceae* R.Br. ex Rich.
 - §*Campanulaceae* Juss. (including *Lobeliaceae* Juss.)
 - *Goodeniaceae* R.Br.
 - *Menyanthaceae* Dumort.
 - *Pentaphragmataceae* J.Agardh
 - *Phellinaceae* Takht.
 - *Rousseaceae* DC.
 - §*Stylidiaceae* R.Br. (including *Donatiaceae* B.Chandler)
- †*Escalloniales* R.Br.
 - §*Escalloniaceae* R.Br. ex Dumort. (including *Eremosynaceae* Dandy, *Polyosmaceae* Blume, *Tribelaceae* Airy Shaw)
- †*Bruniales* Dumort.
 - *Bruniaceae* R.Br. ex DC.
 - §*Columelliaceae* D.Don (including *Desfontainiaceae* Endl.)
- †*Paracryphiales* Takht. ex Reveal
 - §*Paracryphiaceae* Airy Shaw (including **Quintiniaceae* Doweld, *Sphenostemonaceae* P.Royen & Airy Shaw)

- *Dipsacales* Juss. ex Bercht. & J.Presl
 - *Adoxaceae* E.Mey.
 - §*Caprifoliaceae* Juss. (including *Diervillaceae* Pyck, *Dipsacaceae* Juss., *Linnaeaceae* Backlund, *Morinaceae* Raf., *Valerianaceae* Batsch)
- *Apiales* Nakai
 - *Apiaceae* Lindl.
 - *Araliaceae* Juss.
 - *Griselinaceae* J.R.Forst. & G.Forst. ex A.Cunn.
 - *Myodocarpaceae* Doweld
 - *Pennantiaceae* J.Agardh
 - *Pittosporaceae* R.Br.
 - §*Toricelliaceae* Hu (including *Aralidiaceae* Philipson & B.C.Stone, *Melanophyllaceae* Takht. ex Airy Shaw)

Taxa of uncertain position

- *Apodanthaceae* Takht. (three genera)
- *Cynomoriaceae* Endl. ex Lindl.
- *Gumillea* Ruiz & Pav.
- *Petenaea* Lundell (probably in *Malvales*)
- *Nicobariodendron* (see Simmons, 2004; probably in *Celastraceae*).

Subfamilies replacing discontinued families

The number of Subfamilies replacing APG II bracketed families is reported in table 1.

Table 1 - A number of subfamilies have been proposed to replace some of the families which were optional (i.e. bracketed) in APG II, but have been discontinued in APG III.^[5] These are shown in the table below.

Subfamilies replacing APG II bracketed families	
APG II bracketed family	APG III family: subfamily
<i>Agapanthaceae</i>	<i>Amaryllidaceae: Agapanthoideae</i>
<i>Agavaceae</i>	<i>Asparagaceae: Agavoideae</i>
<i>Alliaceae</i>	<i>Amaryllidaceae: Allioideae</i>
<i>Amaryllidaceae</i>	<i>Amaryllidaceae: Amaryllidoideae</i>
<i>Aphyllanthaceae</i>	<i>Asparagaceae: Aphyllanthoideae</i>
<i>Asparagaceae</i>	<i>Asparagaceae: Asparagoideae</i>
<i>Asphodelaceae</i>	<i>Xanthorrhoeaceae: Asphodeloideae</i>
<i>Hemerocallidaceae</i>	<i>Xanthorrhoeaceae: Hemerocallidoideae</i>
<i>Hesperocallidaceae</i>	<i>Asparagaceae: Agavoideae</i>
<i>Hyacinthaceae</i>	<i>Asparagaceae: Scilloideae</i>
<i>Laxmanniaceae</i>	<i>Asparagaceae: Lomandroideae</i>
<i>Ruscaceae</i>	<i>Asparagaceae: Nolinoideae</i>
<i>Themidaceae</i>	<i>Asparagaceae: Brodiaeoideae</i>
<i>Xanthorrhoeaceae</i>	<i>Xanthorrhoeaceae: Xanthorrhoeoideae</i>

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