Comparison of classifications of vascular plants of China

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Abstract China has 31,362 species of vascular plants, more than any country on the planet except Brazil and Colombia, and this number represents 8%–12% of the world diversity of vascular plants. With the two largest completed floristic projects in the world, a full documentation of the vascular plants of China has been published twice over the past 54 years: the Chinese-language *Flora Reipublicae Popularis Sinicae* (*FRPS*), 1959–2004, and the English-language *Flora of China* (*FOC*), 1994–2013. With the advent of molecular phylogenetics the past half century has witnessed dramatical changes of classifications of vascular plants. In this paper, we compare the circumscriptions of all families of vascular plants occurring within China in *FRPS*, *FOC*, and the Angiosperm Phylogeny Group (APG) III system when applicable, and summarize familial assignments of all controversial genera in the different classifications. Such comparison to some extent reflects the history of classification of vascular plants and differences between classical morphology-based classifications and modern DNA (mainly chloroplast) sequence data-based classifications of vascular plants.

Keywords APG III; Englerian system; familial assignments of genera; flowering plants; *FOC*; *FRPS*; pteridophytes

Supplementary Material The Electronic Supplement (Tables S1–S8) is available in the Supplementary Data section of the online version of this article at http://www.ingentaconnect.com/iapt/tax

■ INTRODUCTION

The diversity of extant vascular plants in China is extraordinary. China, the continental United States, and Europe have very similar areas of about 9.6, 9.4, and 9.9 million square kilometers, respectively, but China has 31,362 species of vascular plants as documented in a recently completed project, the *Flora of China* (*FOC*) project (Wu & Raven, 1994–2001b; Wu & al., 2001–2013d), while the United States and Canada combined have about 19,000 species (Thorne, 1993; Govaerts, 2001), and Europe has some 11,500–13,600 species (Tutin & al., 1993, Govaerts, 2001), making the ratio of numbers of species in the three areas approximately 3 to 2 to 1. There are a number of factors to account for these differences in diversity but the most important must be that China includes a significant area of moist tropical and subtropical regions, almost absent in the U.S.A. and totally absent in Europe.

The floristic documentation of vascular plants of China has been published twice in the past 54 years from 1959 to 2013: the Chinese-language *Flora Reipublicae Popularis Sinicae* (*FRPS*) and the English-language *Flora of China*. The *FRPS* project was initiated in the 1930s by Hu Xiansu, more widely known as H.H. Hu (Chen & al., 2004), and its first volume was published in September 1959 and the last in August 2004. The whole project consists of 126 parts in 80 volumes dealing with 31,141 species in 3407 genera and 301 families of vascular plants (Editorial Committee of *FRPS*, 1959–2004; number of genera and species from Yang & al., 2005), of which 2606 species are ferns and lycophytes, 236 are gymnosperms, and 28,299 are angiosperms. The *FRPS* project took 45 years of extraordinary effort by four generations of Chinese botanists, a total of 323 individuals (Ma & Clements, 2006).

The English-language *Flora of China* is a revision of *FRPS* and an international collaborative scientific effort to publish the first modern English-language account of the species of vascular plants of China. The early parts of *FRPS* had been written with rather restricted access to most early type material and collections from neighboring countries, and it was felt important to check Chinese taxonomic concepts against those formulated elsewhere. To this end, all but one of the accounts were produced jointly by Chinese taxonomists, who took the leading role, and "Western" co-authors. The *FOC* project was officially launched on 7 October 1988 at Missouri Botanical Garden, St. Louis, Missouri, U.S.A. (Wu & al., 2013d). The first *FOC* text volume was published in September 1994 (Wu & Raven, 1994), the first accompanying illustration volume in September 1998 (Wu & Raven, 1998b), the last text volume in June 2013 (Wu & al., 2013a), and the last illustration volume in September 2013 (Wu & al., 2013c). The whole *FOC* project published 49 volumes (24 text volumes, 24 illustration volumes, and one introductory volume; Wu & Raven, 1994–2001b; Wu & al., 2001–2013d) documenting 31,362 species of vascular

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plants in 3328 genera and 312 families, of which 2129 species are ferns and lycophytes, 237 are gymnosperms, and 28,996 are angiosperms (Wu & al., 2013d). The *FOC* project took 25 years of endeavor by 478 authors and 324 artists from 30 countries (Wu & al., 2013d).

In order to facilitate comparison with *FRPS*, the decision was made at the start of the *FOC* project to follow the modified Englerian family sequence for seed plants used in *FRPS* (Editorial Committee of *FRPS*, 1961–2002), the only major change being to move the monocotyledons to the end of the sequence. Otherwise the policy was to keep to the *FRPS* system and only draw attention to any alternatives in comments after the family description (e.g., Liliaceae and Amaryllidaceae, Wu & Raven, 2000b: 73, 264). Only in some of the later volumes were there significant changes reflecting the widespread acceptance of APG III (e.g., the aquatic monocots, Wu & al., 2012b: 84–119). This was not the case for the pteridophytes (or monilophytes: lycophytes and ferns) where the sequence and family delimitations follow exactly the most recent system of Christenhusz & al. (2011), a modified Smith & al. (2006) system, and not the partly arbitrary sequence used in *FRPS*.

In this paper, we compare the classifications of vascular plants of China in the *FRPS*, *FOC*, and APG III systems in the form of tables (Electr. Suppl.: Tables S1–S8). The need for this comparison of classifications comes from two directions, namely consideration of the value of plants as indicated by their taxonomy, and the history of plant taxonomy in China. Classifications are valued for their predictive value and modern molecular methods are the latest tools in our successive approximation to recognize past superficial similarities and convergent evolution and try to work out the evolutionary history of plants. Groups with a common origin and thus similar genomes are obviously more likely to have properties in common than those that are not closely related. In effect a classification acts as a sales catalog for our most vital natural resource upon which all life depends. The most obvious example in China is the immense interest in medicinal plants which play an extremely important part in health care. Certain species are noted for their ability to treat certain conditions, and it is obvious that plants related to these are more likely to have similar pharmaceutical properties. The same applies to plant breeders and agronomists who have an increasing interest in wild relatives of crops, to ecologists, for whom understanding of a particular habitat is dependent on knowledge of the history of the vegetation of the area which in turn means knowing something about the plant geography and thus the evolutionary history of the species present.

The comparison tables (Electr. Suppl.: Tables S1–S8) are also available in the final published *FOC* volume, 1 (Wu & al., 2013d: 41–89), but *FOC* volume 1 is less accessible to general readers. Most importantly, in *FOC* volume 1 there is no background information, discussion, references, statistics, or summary information. A few errors in *FOC* volume 1 regarding delimitation of Apiaceae/Araliaceae, and Scrophulariaceae/Orobanchaceae, and errors in *FRPS* page numbers in table 3 and 24 typographical errors of Chinese names of families in table 7 in *FOC* volume 1 are corrected here.

■ MATERIALS AND METHODS

The delimitations of *FRPS* families followed *FRPS* volumes 2–80 (Editorial Committee of *FRPS*, 1959–2004a). Those of the *FOC* families followed *FOC* volumes 2–25 (Wu & Raven, 1994–2001b; Wu & al., 2001–2013d). However, the assignment of genera of angiosperms was often not explicit in APG III which is mostly a list of accepted families and the orders they are classified into and thus re-delimitations of many of the families were not based on APG III alone. Consultation of multiple sources of information (e.g., molecular studies, descriptions of genera and families, etc.) and further taxonomic decisions were necessary. The AP web (Stevens, 2001–) played an important role in deciding how genera were placed. In many cases, the most recent molecular works were examined when determining family membership of some genera (see Results and Discussion).

■ RESULTS AND DISCUSSION

The comparison of classifications of vascular plants of China in *FRPS*, *FOC*, and APG III (for angiosperms), is presented in eight Tables available online in the Electronic Supplement:

- Table S1: Comparison of *FRPS* and *FOC* classifications of pteridophyte and gymnosperm families sorted by *FRPS* volume and page number.
- Table S2: Comparison of *FRPS* and *FOC* classifications of pteridophyte and gymnosperm families sorted alphabetically by *FRPS* family.
- Table S3: Comparison of *FRPS* and *FOC* classifications of pteridophyte and gymnosperm families sorted by Chinese name.
- Table S4: Comparison of *FRPS* and *FOC* classifications of pteridophyte and gymnosperm families sorted alphabetically by *FOC* family.
- Table S5: Comparison of *FRPS*, *FOC*, and APG III classifications sorted by *FRPS* volume and page number.
- Table S6: Comparison of *FRPS*, *FOC*, and APG III classifications sorted by *FRPS* family name.
- Table S7: Comparison of *FRPS*, *FOC*, and APG III classifications sorted by Chinese name.
- Table S8: Comparison of *FRPS*, *FOC*, and APG III classifications sorted by APG III family.

The *Flora of China* (*FOC*) represents 8%–12% of the world diversity of vascular plants depending on estimates of species numbers of vascular plants of the world (ca. 422,000 spp., Govaerts, 2001, Bramwell, 2002; ca. 260,000 spp., Thorne, 2002; ca. 268,000 spp., Palmer & al., 2004; 253,300 spp., Thorne & Reveal, 2007). China has about 7000 native species of ornamental and economic value, in particular, a higher number of medicinal plants that are more actively traded and used than any other country in the world. This practice is expanding with the establishment of Traditional Chinese Medicine (TCM) practitioners outside China.

Lycophytes and ferns. — For the lycophytes and ferns of China (Electr. Suppl.: Tables S1–S4), *FRPS* (vols. 2–6(3); Editorial Committee of *FRPS*, 1959, 1990a, 1999a, b, c, d, 2000a, b, 2001a, 2004a) recognized 62 families while *FOC* (vol. 2–3) accepted only 38 families (Wu & al., 2013b). Nineteen out of the 62 families of lycophytes and ferns in *FRPS* have the same delimitation as in *FOC* (Electr. Suppl.: Table S1). These 19 families themselves each are morphologically homogeneous and the circumscription of these families has rarely been controversial (Ching, 1940; Copeland, 1947; Holttum, 1947; Pichi Sermolii, 1977; Ching, 1978; Tryon & Tryon, 1982; Kramer & Green, 1990; Smith & al., 2006; Christenhusz & al., 2011).

Twenty-six out of the 62 families in *FRPS* were merged with other families in *FOC*, suggesting that the circumscription of these 26 *FRPS* families is narrower than the corresponding families recognized in *FOC*. Notably, based on chloroplast sequence data, many of these 26 families sensu *FRPS* merged in *FOC* are apparently monophyletic but are nested within other families, e.g., Adiantaceae (in Pteridaceae; Schuettpelz & al., 2007; Rothfels & Schuettpelz, 2014), Bolbitidaceae (in Dryopteridaceae; Liu & al., 2007), Botrychiaceae (in Ophioglossaceae; Dauphin & al., 2014), Ceratopteridaceae (in Pteridaceae; Schuettpelz & al., 2007; Zhang & al., 2014), Elaphoglossaceae (in Dryopteridaceae; Liu & al., 2007), Huperziaceae (in Lycopodiaceae; Wikström & Kenrick, 2001), etc.

Seven families in *FRPS* each were dismantled and some but not all of their members transferred to other families in *FOC*. These seven families are Athyriaceae, Davalliaceae, Dryopteridaceae, Lindsaeaceae, Lomariopsidaceae, Pteridaceae, and Tectariaceae ("Aspidiaceae"). Most notably, members of Athyriaceae sensu *FRPS* were reassigned to three other families in *FOC*: Cystopteridaceae (*Acystopteris* Nakai, *Cystoathyrium* Ching, *Cystopteris* Bernh., and *Gymnocarpium* Newman), Diplaziopsidaceae (*Diplaziopsis* C. Chr.), Rhachidosoraceae (*Rhachidosorus* Ching), leaving just five genera in the Athyriaceae s.str., and members of Davalliaceae sensu *FRPS* (vol. 2) were transferred to four other families in *FOC*: Hypodematiaceae (*Hypodematium* Kunze), Nephrolepidaceae (*Nephrolepis* Schott), Polypodiaceae (*Gymnogrammitis* Griff.), and Tectariaceae (*Arthropteris* J.Sm.), leaving four genera in the Davalliaceae s.str. Not surprisingly, these two families have been shown to be highly polyphyletic using chloroplast sequence data (Rothfels & al., 2013 for Athyriaceae; Tsutsumi & al., 2008 for Davalliaceae).

Both *FRPS* and *FOC* recognized Blechnaceae, Dennstaedtiaceae, Dipteridaceae, Huperziaceae, Hypodematiaceae, Marattiaceae, Ophioglossaceae, Polypodiaceae, and Salviniaceae, but the delimitations of these nine families in *FOC* are broader than those in *FRPS*.

The only member of one family, Dicksoniaceae, in *FRPS*, is accommodated in Cibotiaceae in *FOC*.

The most accommodating families in *FOC* in comparison with their delimitations in *FRPS* are Dryopteridaceae, Polypodiaceae, and Pteridaceae. The largest fern family Dryopteridaceae in *FOC* (Zhang & al., 2013) contains Bolbitidaceae, Dryopteridaceae (excl. *Cyclopeltis* J.Sm.; Lu & Li, 2006), Elaphoglossaceae, part of Lomariopsidaceae (*Lomagramma* J.Sm.), Peranemataceae ("Peranemaceae"; Zhang & Zhang, 2012; Zhang & al., 2012), and part of Tectariaceae (*Ctenitis* C.Chr., *Lastreopsis* Ching; Liu & al., 2007) sensu *FRPS*. Polypodiaceae sensu *FOC* include Drynariaceae, Grammitidaceae, Gymnogrammitidaceae, Loxogrammaceae, Platyceriaceae, Pleurosoriopsidaceae, and Polypodiaceae sensu *FRPS*. Pteridaceae sensu *FOC* contains Acrostichaceae, Adiantaceae, Antrophyaceae, Ceratopteridaceae (Parkeriaceae), Hemionitidaceae, Pteridaceae, Vittariaceae, and portion of Lindsaeaceae sensu *FRPS*.

Gymnosperms. — For gymnosperms of China (Electr. Suppl.: Tables S1–S4), *FRPS* (vol. 7; Editorial Committee of *FRPS*, 1978a) recognized 11 families while *FOC* accepted 12 (vol. 4; Wu & Raven, 1999a). In the *FOC* treatment Taxodiaceae were divided into Taxodiaceae (excl. *Sciadopitys* Siebold & Zucc.) and Sciadopityaceae. The recognition of Sciadopityaceae in *FOC* is in line with molecular studies (Brunsfeld & al., 1994; Tsumura & al., 1995; Stefanović & al., 1998). More recent studies have included Taxodiaceae in Cupressaceae (Farjon, 2005).

Angiosperms. — For angiosperms of China (Electr. Suppl.: Tables S5–S8), *FRPS* recognized 226 families, of which 2 (Nymphaeaceae, Schisandraceae) and part of another one (Magnoliaceae) fall in the basal angiosperms or so-called ANA group (Amborellales, Nymphaeales, Austrobaileyales), 38 in monocots, 10 in magnoliids (incl. Chloranthales), 1 in Ceratophyllales, and 175 in eudicots. In contrast, *FOC* recognized 262 families of angiosperms, a significant increase (36 more families) from the number of families recognized in *FRPS*. Of the 262 *FOC* families, 4 fall in the basal angiosperms, 46 in the monocots, 10 in the magnoliids, 1 in the Ceratophyllales, and 201 in the eudicots. The *FOC* families not recognized in *FRPS* are concentrated in monocots (10 families) and eudicots (25 families).

Two hundred and twenty-seven *FOC* families were published before APG III was published in 2009. All except six *FRPS* families are recognized in *FOC*. The exceptions are Hippocrateaceae, Najadaceae, Pyrolaceae, Sonneratiaceae, Sparganiaceae, and Theligonaceae. Five of these *FRPS* families each are included within closely related families. The exception is Najadaceae whose Chinese members were moved to three families in *FOC*, two of which were also recognized in APG III: Cymodoceaceae (*Cymodocea* K.D.Koenig), Hydrocharitaceae (*Najas* L.), and Zannichelliaceae (*Zannichellia* L., moved to the Potamogetonaceae in APG III).

Following the APG III classification, there are 259 families of angiosperms in China (Electr. Suppl.: Table S8), of which 198 families are also recognized in *FRPS*, and 229 families in *FOC*; 58 out of the 198 families recognized by both *FRPS* and APG III have different delimitation, and 42 out of the 229 families recognized by both *FOC* and APG III have different delimitations. These numbers suggest that the *FOC* treatment at familial level is closer to the APG III classification than to the *FRPS* treatment, a reflection of the change in policy for the later volumes.

Of the 218 families recognized in both *FRPS* and *FOC*, 188 families have the same delimitation (Electr. Suppl.: Table S6). Of the 199 families recognized in *FRPS*, *FOC*, and APG III, 139 families in *FRPS* and *FOC* have the same delimitation as in the APG III classification.

A newly described family of Brassicales, Borthwickiaceae, segregated from Capparaceae (Su & al., 2012), is not included in *FRPS*, *FOC* or APG III.

Below are summaries of classifications of basal angiosperms, monocots, magnoliids, Ceratophyllales, and eudicots in *FRPS*, *FOC*, and APG III.

(1) Basal angiosperms. – *FRPS* recognized only two families, Nymphaeaceae and Schisandraceae, in the ANA group. *FOC* and APG III divided Nymphaeaceae sensu *FRPS* into Cabombaceae, Nelumbonaceae, and Nymphaeaceae, placing Nelumbonaceae in the eudicot order Proteales (Xue & al., 2012 and references therein for the phylogeny of Nelumbonaceae). *FOC* recognized four families in the ANA group: Cabombaceae, Illiciaceae, Nymphaeaceae, and Schisandraceae. Illiciaceae and Schisandraceae were placed in Magnoliaceae in *FRPS*. APG III included Illiciaceae in Schisandraceae.

(2) Monocots. – The classifications of monocots of China are dramatically different between *FRPS* and *FOC* treatments. *FRPS* recognized 38 families of monocots, while *FOC* recognized 46 families. Potamogetonaceae were most differently treated in *FRPS* and *FOC*/APG III. It was found that the adaptations associated with the aquatic habitat are striking and that the previously morphologically defined Potamogetonaceae s.l. was polyphyletic based on molecular data (Les & Tippery, 2013 and references therein). Potamogetonaceae sensu *FRPS* were divided between 6 families in *FOC*: Cymodoceaceae (*Halodule* Endl., *Syringodium* Kütz.), Juncaginaceae (*Triglochin* L.), Posidoniaceae (*Posidonia* K.D.Koenig), Potamogetonaceae (*Potamogeton* L.), Ruppiaceae (*Ruppia* L.), and Zosteraceae (*Phyllospadix* Hook., *Zostera* L.). This treatment is consistent with APG III and molecular analyses (Les & Tippery, 2013 and references therein). In addition, members of Najadaceae sensu *FRPS* in China were transferred to three families (see above).

Amaryllidaceae and Liliaceae had the same circumscription in *FRPS* and *FOC*, but their delimitation changed dramatically in APG III. Amaryllidaceae sensu *FRPS* and *FOC* were divided between 5 families: Amaryllidaceae s.str., Asparagaceae, Hypoxidaceae, Ixioliriaceae, and Velloziaceae in APG III, whilst Liliaceae sensu *FRPS* and *FOC* were separated into 10 families: Amaryllidaceae, Asparagaceae, Colchicaceae, Liliaceae, Melanthiaceae, Nartheciaceae, Petrosaviaceae, Smilacaceae, Tofieldiaceae, and Xanthorrhoeaceae. Additionally, Musaceae sensu *FRPS* was divided into Heliconiaceae, Lowiaceae, Musaceae, and Strelitziaceae in *FOC* and APG III, and Araceae sensu *FRPS* into Acoraceae and Araceae in *FOC* and APG III. The Lemnaceae was recognized in *FRPS* and *FOC* but subsumed into the Araceae in APG III. These changes were based mainly on chloroplast DNA data (e.g., Kim & al., 2012 for Amaryllidaceae; Kim & al., 2013 for Liliaceae; Yockteng & al., 2013 for Musaceae).

(3) Magnoliids. – The classification of magnoliids of China has been less controversial. The same 10 families of magnoliids of China in *FRPS* were recognized in *FOC* and APG III: Annonaceae, Aristolochiaceae, Calycanthaceae, Chloranthaceae, Hernandiaceae, Lauraceae, Magnoliaceae, Myristicaceae, Piperaceae, and Saururaceae. The delimitation of these families in the three classifications is the same except for Magnoliaceae. Magnoliaceae sensu *FRPS* were divided into Illiciaceae, Magnoliaceae, and Schisandraceae in *FOC*, while APG III merged Illiciaceae in Schisandraceae. The latter was placed in Austrobaileyales, a basal angiosperm group, in APG III.

(4) Ceratophyllales. – One family, Ceratophyllaceae, was recognized in FPRS, *FOC*, and APG III with the same delimitation. Three out of the six species of this monogeneric family occur in China (Wu & al., 2003c).

(5) Eudicots. – *FRPS* classified the eudicots of China into 176 families, while *FOC* recognized 201 families for the same group. Twenty-nine families of eudicots sensu *FRPS* each were separated into 2–6 families in *FOC* and/or APG III. These families include Actinidiaceae, Aizoaceae, Campanulaceae, Capparaceae, Caprifoliaceae, Celastraceae, Clusiaceae, Cornaceae, Dipsacaceae, Euphorbiaceae, Flacourtiaceae, Gentianaceae, Geraniaceae, Loganiaceae, Loranthaceae, Moraceae, Rafflesiaceae, Ranunculaceae, Rubiaceae, Saxifragaceae, Scrophulariaceae, Simaroubaceae, Staphyleaceae, Theaceae, Tiliaceae, Ulmaceae, Verbenaceae, Vitaceae, and Zygophyllaceae. The most striking changes were in Euphorbiaceae, Saxifragaceae, Scrophulariaceae, and Verbenaceae. *FRPS* and *FOC* had the same delimitation for these four families, but APG III, which was published after the *FOC* accounts, drastically re-defined them. Euphorbiaceae sensu *FRPS* and *FOC* were divided into Euphorbiaceae, Phyllanthaceae, and Putranjivaceae. Saxifragaceae sensu *FRPS* and *FOC* were divided among Celastraceae, Escalloniaceae, Grossulariaceae, Hydrangeaceae, Iteaceae, and Saxifragaceae s.str. in APG III. Scrophulariaceae sensu *FRPS* and *FOC* were divided into Linderniaceae, Orobanchaceae, Paulowniaceae, Phrymaceae, Plantaginaceae, and Scrophulariaceae s.str. in APG III. In the case of Verbenaceae sensu *FRPS* and *FOC*, one genus (*Avicennia* L.) was transferred to the Acanthaceae in APG III whilst the dividing line between the Lamiaceae and Verbenaceae s.str. was drastically changed with a majority of Chinese species of Verbenaceae being moved to Lamiaceae. In addition, Zygophyllaceae sensu *FRPS* were divided into Nitrariaceae, Peganaceae, and Zygophyllaceae in *FOC*, while APG III combined Nitrariaceae and Peganaceae and only recognized Nitrariaceae and Zygophyllaceae. Aizoaceae sensu *FRPS* were separated into Aizoaceae and Molluginaceae in *FOC* whilst APG III further recognizes a third family, Gisekiaceae. All these changes reflect the DNA sequence data-based phylogenetic analyses of the past 30 years or so (a review by Stevens, 2001–).

Sixteen families recognized in both *FRPS* and *FOC* were merged into other families in APG III. These families include Aceraceae (to Sapindaceae), Alangiaceae (Cornaceae), Asclepiadaceae (Apocynaceae), Bombacaceae (Malvaceae), Callitrichaceae (Plantaginaceae), Chenopodiaceae (Amaranthaceae), Empetraceae (Ericaceae), Flacourtiaceae (Salicaceae and Achariaceae), Hippocastaneaceae (Sapindaceae), Hippuridaceae (Plantaginaceae), Myoporaceae (Scrophulariaceae), Myrsinaceae (Primulaceae), Nyssaceae (Cornaceae), Sonneratiaceae and Trapaceae (Lythraceae), and Valerianaceae (Caprifoliaceae).

Tiliaceae sensu *FRPS* were divided into Plagiopteraceae and Tiliaceae in *FOC* but in APG III Plagiopteraceae were

transferred to Celastraceae and Tiliaceae included within Malvaceae along with Sterculiaceae and Bombacaceae.

Dipentodontaceae contain only *Dipentodon* Dunn in *FRPS* and APG III, while this family in *FOC* also contains *Perrottetia* Kunth based on morphological and molecular evidence (Zhang & Simmons, 2006; Worberg & al., 2009).

Brandisia Hook.f. & Thomson, *Paulownia* Siebold & Zucc., and *Wightia* Spreng. ex DC. were included in Scrophulariaceae in both *FRPS* and *FOC*, while *Paulownia* was included in Paulowniaceae in APG III. Based on recent molecular work, *Brandisia* and *Wightia* should be members of Orobanchaceae (McNeal & al., 2013).

The most accommodating family of eudicots of China sensu APG III is Cornaceae which include Alangiaceae sensu *FRPS*, Nyssaceae sensu *FRPS*, Mastixiaceae sensu *FOC*, and part of Cornaceae sensu *FRPS*.

Species of three *FOC* families: Cardiopteridaceae, Corsiaceae, and Tetracentraceae, were not treated in *FRPS*. APG III recognized Cardiopteridaceae and Corsiaceae but merged Tetracentraceae into Trochodendraceae.

■ CONCLUSIONS

The classifications of vascular plants of China in *FRPS*, *FOC*, and APG III (for angiosperms) are very different. *FRPS* classified lycophytes and ferns, gymnosperms, and angiosperms of China into 64, 11, and 226 families, respectively; in contrast, *FOC* recognized 38, 12, and 262 families, respectively, for these groups, while APG III recognized 259 families of angiosperms in China. For the families recognized by all three treatments, circumscriptions can be dramatically different. However, more than half (139) of the families of angiosperms of China sensu APG III have the same delimitations in all three classifications.

A comparison of classifications of vascular plants of China in *FRPS*, *FOC*, and APG III (when applicable), is meaningful not only for botanists, ecologists, conservationists, horticulturists, and medical researchers and practitioners of China, but also for those international scientists who are interested in Asian botany.

Interestingly, a comparison of classifications of vascular plants of China to a large extent reflects the history of classification of vascular plants and the transition from early morphology-based classifications to modern DNA (mainly chloroplast) sequence data-based classifications, although in many cases the recircumscribed families and orders can be linked with anatomical and/or morphological features.

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