

(0000) Proposal to conserve the name *Pterophyllum* (fossil *Bennettitales*) with a conserved type

Christian Pott^{1,6}, Ian M. Miller^{2,6}, Hans Kerp¹, Johanna H.A. van Konijnenburg-van Cittert^{3,4} & Gea Zijlstra⁵

¹ *Forschungsstelle für Paläobotanik, Geologisch-Paläontologisches Institut, Hindenburgplatz 57, 48143 Münster, Germany. christian.pott@uni-muenster.de (author for correspondence)*

² *Denver Museum of Nature and Science, 2001 Colorado Blvd., Denver, Colorado 80205-5798, U.S.A.*

³ *National Natural History Museum Naturalis, P.O. Box 9517, 2300 RA Leiden, The Netherlands*

⁴ *Laboratory of Palaeobotany and Palynology, Budapestlaan 4, 3584 CD Utrecht, The Netherlands*

⁵ *Nationaal Herbarium Nederland, Utrecht University branch, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands*

⁶ *The conclusions of this proposal were reached independently by research groups led by C. Pott and I. Miller. The current proposal is a collaborative effort between these groups.*

(0000) *Pterophyllum* Brongn. in Ann. Sci. Nat. (Paris) 4: 211. Feb 1825 ('1824'), nom. cons. prop.
 Typus: *P. longifolium* Brongn. (Prodr. Hist. Vég. Foss.: 95. Dec 1828) nom. illeg. (*P. filicoides* (Schloth.) Zeiller, *Algacites filicoides* Schloth.), typ. cons. prop.

Brongniart (l.c.: 216. 1825) introduced the name *Pterophyllum* for a genus comprising two species of fossil pinnate leaves, *P. minus* and *P. majus*, from the uppermost Triassic of southern Sweden and assigned them to the *Cycadaceae*. He also discussed the cycadalean nature of *Algacites filicoides* Schloth. (Petrefaktenkunde Nachträge: 47. 1822), which had originally been interpreted as an alga, but did not assign this species to *Pterophyllum* or to any other cycadalean genus despite its pinnate cycad-like foliage. Three years later, Brongniart (Prodr. Hist. Vég. Foss.: 95. 1828) gave a new, largely identical diagnosis of *Pterophyllum* to which he attributed six species; two others were mentioned as doubtful. In addition to *P. minus* and *P. majus* he listed four names under *Pterophyllum*, two of them being nomina nuda (*P. meriani*, *P. williamsonis*). He transferred *Algacites filicoides* Schloth. and *Osmundites pectinatus* Jaeger (Pfl.-Versteiner.: 29. 1827) to *Pterophyllum* but he did not adopt the original specific epithets and instead renamed them as *P. longifolium* and *P. jaegeri* respectively, these latter names thus being illegitimate. Nathorst subsequently transferred *P. minus* and *P. majus* (in Öfv. Kongl. Vetenskaps-Akad. Handl. 1: 34. 1876) to the genus *Anomozamites* Schimper 1870 (Traité Paléont. Vég. 2: 140. 1870). Accepting this transfer implies that without conservation, *Pterophyllum* (typified on either *P. minus* or *P. majus*), has to replace *Anomozamites*, whereas for the genus in the enlarged sense of Brongniart (1828), no name is available. *Pterophyllum* is still widely used as a morphogenus for pinnate leaves and the generic diagnosis has been emended by Harris (Yorksh. Jurassic Fl. 3: 92. 1969) and Watson & Sincock (Bennettitales Engl. Wealden: 108. 1992) to include only species with syndetocheilic stomata of the bennettitalean type.

The *Cycadales* and *Bennettitales* are two groups of superficially similar gymnosperms that possess several fundamental differences. Members of both groups display a similar growth habit, and the foliage is often macromorphologically very similar. However, leaves with preserved cuticles can be distinguished on the basis of epidermal anatomy. The reproductive structures of *Cycadales* and *Bennettitales* are very dissimilar. Collectively, this evidence indicates that the two groups are not closely related, a conclusion supported by cladistic analysis. However, researchers do not entirely agree on the phylogenetic position of the *Bennettitales*, e.g., Crane (in Ann. Missouri Bot. Gard. 72: 716–793. 1985; in Cladistics 1: 329–348. 1985), Nixon & al. (in Ann. Missouri Bot. Gard. 81: 484–533. 1994), Rothwell & Serbet (in Syst. Bot. 19: 443–482. 1994), Doyle (in J. Torrey Bot. Soc. 133: 169–209. 2006), and Hilton & Bateman (in J. Torrey Bot. Soc. 133: 119–168. 2006).

The order *Bennettitales* was not established until 1892 by Engler (Syllabus: 61. 1892). Thomas & Bancroft (in Trans. Linn. Soc. London, Bot. 8: 155–203. 1913) first distinguished cycadalean and bennettitalean foliage based on epidermal anatomy.

Algacites filicoides was described by Schlotheim in 1822 (l.c.: 47. 1822), who figured a single specimen from the Carnian (Upper Triassic) of Neuwelt near Basel (Switzerland) (l.c.: pl. IV, fig. 2. 1822) that is now kept in the Museum für Naturkunde der Humboldt-Universität zu Berlin. Zeiller (Bassin Houill. Blanzky Creusot: 196. 1906) replaced *Pterophyllum longifolium* by *P. filicoides*, thus making the correct new combination. However, he illustrated a cuticle of a specimen from the type locality that does not show the typical stomata. Thomas (in J. Linn. Soc., Bot. 47: 407. 1930) illustrated cuticles with stomata from the Carnian of Lunz (Austria) and thereby emended *Pterophyllum filicoides*. Although the latter name is legitimate, it was hardly ever adopted by subsequent authors; the species is mostly still referred to as *P. longifolium* (see: Jongmans & Dijkstra, Foss. Cat. 56: 2716–2718. 1963; Dijkstra & van Amerom, Foss. Cat. 91:

594. 1985). Andrews (in Bull. U.S. Geol. Surv. 1300: 179. 1970) claimed to select *P. longifolium* as type of *Pterophyllum*, disregarding the fact that it was not eligible, not being an original (1825) species; he also neglected *Algacites filicoides* Schloth. the name which it replaced and *P. filicoides*, the correct new combination.

Jongmans & Dijkstra (l.c.: 2691–2744. 1963) and Dijkstra & van Amerom (l.c.: 588–601. 1985) list ca. 265 species of *Pterophyllum*. The genus is clearly in need of revision. The few species reported from the Upper Carboniferous and Permian (e.g., Geinitz, *Dyas* 2: 146. 1862; Renault & Zeiller, *Étud. Commentry Fl. Foss.*: 619. 1890) can no longer be accommodated in *Pterophyllum*, either because their cuticles do not show the bennettitalean epidermal anatomy (Zeiller, l.c.: 198, fig. B'. 1906) or because cuticles are not known in these fossils. The earliest unequivocal occurrence of *Pterophyllum* with cuticle has been reported from the Carnian and the youngest stratigraphic occurrence is in the Lower Cretaceous. The geographical distribution of *Pterophyllum* is largely restricted to the northern hemisphere, from North America across Europe to eastern Asia.

Several species previously assigned to *Pterophyllum* do not show the typical bennettitalean epidermal anatomy and have been transferred to other genera (e.g., *Anomozamites* Schimper, *Nilssonina* Nathorst; Thomas, l.c.: 389–415. 1930; Pott & al. in *Rev. Palaeobot. Palynol.*

143: 197–217. 2007). On the other hand, detailed studies of species of cycad-like foliage with cuticle preservation, previously assigned to other genera, necessitated their transfer to *Pterophyllum* (Watson & Sincock, l.c.: 108–121. 1992). Even when a critical revision of the genus *Pterophyllum* results in a reduction of the number of species, *Pterophyllum* is still a major constituent of Mesozoic northern hemisphere floras. Especially in Upper Triassic floras *Pterophyllum* is often the dominant taxon, for example in the very rich floras of Lunz and Neuwelt. In accordance with Art. 14.9 of the ICBN (McNeill & al. in *Regnum Veg.* 146. 2006), we propose to conserve the generic name *Pterophyllum* Brongniart 1825 with *Pterophyllum longifolium* Brongn. nom. illeg. (*P. filicoides* (Schloth.) Zeiller, *Algacites filicoides* Schloth.) as type. Rejection of this proposal would require the renaming of a considerable number of *Pterophyllum* species for which no alternative generic name is currently available, and would make it necessary to replace *Anomozamites* by *Pterophyllum*. This would lead to considerable confusion, particularly because the name *Pterophyllum* is not only frequently used in (palaeo)botanical but also in geological literature, including textbooks (e.g., Vakhrameev, *Jur. Cretac. Fl.* 1991; Benton, *Foss. Record.* 1993; Stewart & Rothwell, *Paleobotany.* 1993; Taylor & Taylor, *Biol. Foss. Pl.* 1993; Dobruskina, *Triassic Fl. Eurasia.* 1994).