

POINTS OF VIEW

Brummitt on paraphyly: a response

Gareth Nelson, Daniel J. Murphy & Pauline Y. Ladiges

School of Botany, The University of Melbourne, Victoria 3010, Australia. g.nelson@botany.unimelb.edu.au (author for correspondence); d.murphy@unimelb.edu.au; p.ladiges@unimelb.edu.au

In a dozen oral presentations and five publications over the past eight years, Richard Brummitt (1996, 1997a, b, 2002; Brummitt & Sosef, 1968) has doggedly defended “paraphyletic” taxa, claiming that they are logically required by traditional Linnaean classification. He claims also that “classification into Linnaean taxa without any being paraphyletic is a logical absurdity [impossibility]” (2002: 33, 40): “If we are classifying all the products of evolution, i.e., the whole evolutionary tree of life, every taxon we recognise must make another taxon paraphyletic. That is a simple logical fact”.

To illustrate this fact, Brummitt offered a phylogenetic tree (2002; Fig. 1, top). He did not explain the circles and the lines that interconnect them, but each circle may be seen as a taxon, and each line as an ancestor-descendant relationship between two taxa: “The whole diagram is one clade, and the dark circles together form a... lesser clade within the larger clade. It doesn't matter what rank we are talking about, so, just for the sake of convenience, let us think in terms of genera. If I call all the dark circles one genus defined by the characters at 1, then the open circles must be a different genus.... But then the genus of open circles is paraphyletic...” (Brummitt, 2002: 33). He refers to some circles as ancestors and others as descendants, and the whole as “a diagram of what actually happened in evolution” (p. 37). He does not consider the possibility that the open circles might comprise more than one genus, but he asserts that the circles “have remained comparatively little changed or unchanged—a situation that has arisen millions of times in evolution” (p. 33).

Part of Brummitt's repeated message (Brummitt, 2002) is a challenge: “Until somebody can draw for us a phylogenetic tree...divided fully into Linnaean taxa without any being paraphyletic, we will continue to believe that our arguments on the inevitability of paraphyletic taxa are correct (Brummitt & Sosef, 1998). That was three years ago. We have had no takers. The offer is still open”.

In 1918 such a phylogenetic tree of this type was published by Daniele Rosa (pp. 137–138) with the following remarks: “The following scheme [Fig. 1, bottom] ...represents the connections of affinity between the

species of a group, such as they would be if the species were the result of dichotomous speciation.... Having before us 32 terminal species, represented by the black dots above, we would be able to make four groups (such as genera): A, B, C, D.

“It is clear that, even without paleontological knowledge of the connections, an adequate knowledge of the morphology of these species would suffice to indicate that genus B is more closely related to genus A than to genus C; and that, before grouping the 32 species into four genera, it would be necessary to group them into two ‘supergenera’ or subfamilies: AB and CD. And within each genus it would be possible also to recognise subgenera and even smaller groups of more closely related species”.

“If this scheme corresponds to reality, one may conclude that the distinction between groups of equal taxonomic rank cannot be arbitrary; and also that the distinctions are not caused by gaps in the system, gaps produced by extinction. Even in the absence of extinction, the distinctions would be quite clear. And while it might be arbitrary to consider group A a genus, no good systematist would ever combine some species of group C with AB, and the other species of group C with D”.

Rosa's scheme may be used to illustrate the classification of the eucalypt group, which includes the genus *Angophora* Cavanilles, 1797 (13 species)—corresponding to Rosa's group B. Most remaining eucalypts have traditionally been placed in the genus *Eucalyptus* L'Héritier, 1788 (700+ species)—Rosa's groups A+C+D. *Eucalyptus* was eventually found paraphyletic, with bloodwoods and ghost gums (100+ species), subgenera *Corymbia* and *Blakella* (Pryor & Johnson, 1971), most closely related to *Angophora* (Ladiges & al., 1995; Udovicic & al., 1995). The paraphyly was rectified (Hill & Johnson, 1995) simply by recognising bloodwoods and ghost gums as one genus, *Corymbia*—Rosa's group A—leaving *Eucalyptus* with fewer species (600+)—Rosa's group C+D. Recognising *Corymbia* as a genus does not create paraphyly but rather eliminates it by making *Eucalyptus* monophyletic. For Brummitt, however (Brummitt, 2002: 33), “As soon as we assign a rank to a group, we create paraphyly”.

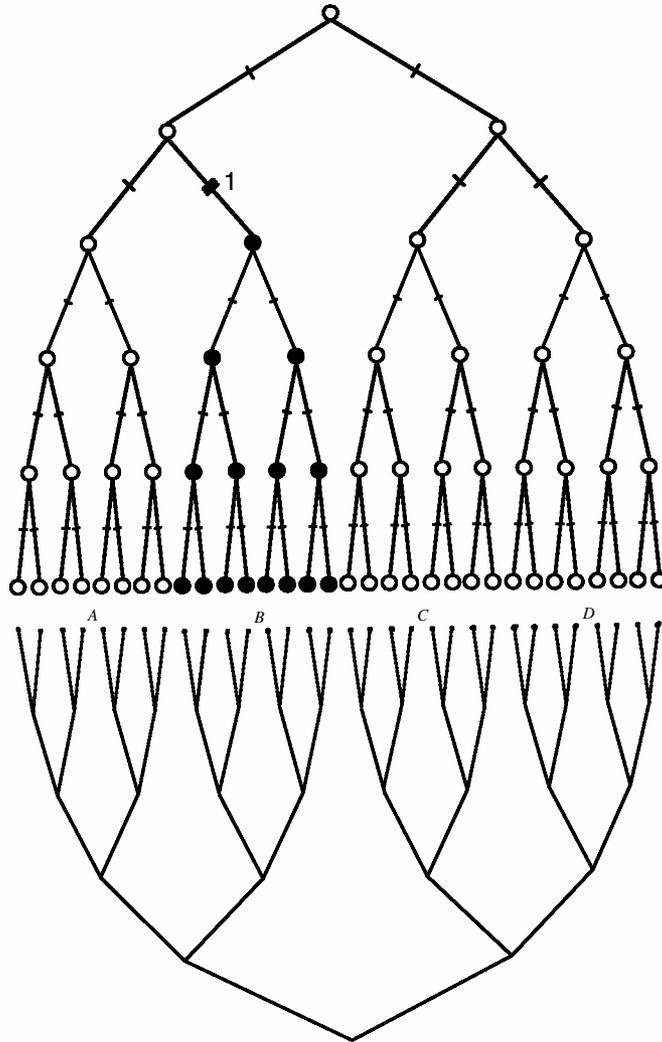


Fig. 1. Phylogenetic trees showing patterns of dichotomous speciation. Above, after Brummitt (2002: fig. 1; “Stylised diagram of a phylogenetic tree in which a major character change has occurred at point 1, giving rise to descendants indicated by darkened circles”). Below, after Rosa [1918: 137–138, “connections of affinity between the species of a group, such as they would be if the species were the result of dichotomous speciation.... Having before us 32 terminal species, represented by the black dots above, we would be able to make four groups (such as genera): A, B, C, D”].

By itself with eucalypts aside, Rosa’s scheme satisfies, at least in part, Brummitt’s criterion of a “tree...divided fully into Linnaean taxa”, but it lacks a taxon for each of its 31 nodes of common ancestry. In a case such as this Brummitt suggests that “paraphyly” is most relevant when extinct taxa come into play (p. 38): “the situation in my Fig. 1 could easily appear...as two sister taxa [Rosa’s two subfamilies?], with neither paraphyletic, if only extant taxa are analysed”.

Consider, then, Rosa’s two subfamilies of extant taxa, AB and CD, and the hypothetical ancestry implied by the first few dichotomies—the basal nodes of his diagram. For each subfamily, imagine an extinct taxon, (AB)e and (CD)e, potentially knowable from fossils, cor-

responding to the two subapical open circles of Brummitt’s tree. Similarly for the entire family imagine a taxon, (ABCD)e, corresponding to the open circle at the apex of his tree.

In Rosa’s scheme, (AB)e would be a third genus in subfamily AB; (CD)e, a third genus in subfamily CD; and (ABCD)e, a genus in a third, monotypic, subfamily in family ABCD. With addition of these three hypothetical taxa, Rosa’s scheme would satisfy Brummitt’s criterion of a fully divided tree, complete with imaginary “fossil ancestors”, as far as the basic divisions are concerned:

- family: ABCD
- subfamily: (ABCD)e

subfamily: AB
 genus: (AB)e
 genus: A
 genus: B
 subfamily: CD
 genus: (CD)e
 genus: C
 genus: D

Additional taxa, subgenera and sections, could be similarly imagined for the remaining 28 nodes of common ancestry.

In practice, extinct ancestral taxa are seldom of concern, because organisms credibly representing them are seldom if ever in hand. For this reason Brummitt's "fully divided tree," if it presupposes a complete fossil record of "what actually happened in evolution," is a theoretical construction, rather than a practical one constrained by empirical data. Even so, as a representation of history's continuum, what credibility is there in a few circles and interconnecting lines?

In a world where all things are possible, one may consider any taxon, extinct or extant, as the ancestor of another. In Rosa's scheme, consider genus A the ancestor of genus B (or B of A), and there is no need of the hypothetical genus (AB)e. Similarly, consider C the ancestor of D (or D of C), and there is no need of (CD)e. Consider subfamily AB the ancestor of subfamily CD (or CD of AB), and there is no need of (ABCD)e. With these considerations extended to subgenera and sections, Rosa's original scheme would completely satisfy Brummitt's criterion.

None of this is novel, being exactly described by George Simpson (1945: 17–18): "In the simplest case of an ancestral unit with two descendant lines, the usual solution in classification is either to extend the name and concept of one descendant group, the one morphologically more conservative if such a distinction is clear, to include the ancestry, or to give the ancestry a separate name and to consider it a group of the same rank as each descendant".

Simpson's views are similar to those of Brummitt, particularly as they concern horizontal classification and its necessity—the deliberate creation of paraphyletic taxa based on evidence of relationship of their subtaxa—which for Simpson is "usually easier and more objective" than vertical classification (1945: 18).

A history of controversy exists over this matter, e.g., over Simpson's Prosimii, non-anthropoid primates (1945: 183). Vertebrate paleontologist Alfred Romer stated (1968: 183): "I do not believe this procedure is the proper one; to lump all forms below the monkey-ape level as Prosimii is comparable to dividing all animals into Vertebrata and Invertebrata. Simpson justifies it primarily on the fact that early lemurs and the tarsoids are

in some cases difficult to sort out. True, but this is to be expected—and even hoped for if the order (Primates) is a natural one; early members of two such groups should be convergent, no matter how far later members of the two have diverged".

Brummitt's "paraphyly" is perhaps better, even best, exemplified by evidence-free assertion such as that of Lewontin (1981): "Birds arose from nonbirds and humans from nonhumans. No person who pretends to any understanding of the natural world can deny these facts". Indeed (Pinto-Correia, 1997: 36, from Chandogya Upanishad 3.19.1): "At the beginning there was nothing but a non-Being. It became the Being". For Colin Patterson (2002: 19), such nonbird, nonhuman, or non-being of paraphyletic groups in general is: "...an abstraction that is beyond criticism...a statement that has the appearance of knowledge but in fact contains none—a piece of antiknowledge, derived from evolutionary theory". Nonbirds, nonhumans, and other such "paraphyletic" notions do not integrate in classification. They do not relate to taxa because they are not mutually exclusive, nor is one wholly inclusive of another. Most nonbirds are also nonhumans and vice versa.

Ancestral taxa may be argued to imply paraphyly (Nelson & Platnick, 1984), even by logical necessity if a person be so disposed. In practice, however, organisms attributed to an ancestral taxon need not represent a paraphyletic assemblage of two or more taxa, as shown by the available evidence of character data. With further study, organisms attributed to any taxon might prove to represent two or more taxa that together form a monophyletic, paraphyletic, or even polyphyletic assemblage. Any such discovery arises only through evidence found relevant to a particular case.

Alleged ancestral taxa in the history of paleontology, not mentioned by Brummitt, often disappear once their internal relationships become evident—as shown by actual evidence in specific cases. Everett Olson (1971: 347) commented on the fate of one such group, Thecodontia, "an array of primitive archosaurian reptiles" that: "...fits well into the 'horizontal' pattern of classification that is often imposed on a 'basal complex' in which lines are difficult to sort out. With increased knowledge, this sorting may take place, and if fully successful, the primitive complex may disappear from classification". Brummitt opposes disappearance of a basal complex, as if evidence of paraphyly should really be seen and valued as evidence of ancestry, which it is not.

For Brummitt, "Evolution is paraphyly all the way": birds from nonbirds, being from nothingness, *ex nihilo omnia*. Persons not of his persuasion in this respect he terms "special creationists". While distancing himself from creationism, he nevertheless adopts its philosophy and its antiknowledge. His stance is at odds with tradi-

tional science and its fundamental maxim, *ex nihilo nihil*—from nothing, nothing comes. By our reading he is at odds also with, and isolated from, the history of systematics, from Aristotle to the present, and its common thread of, or preoccupation with, natural classification and the nature of the evidence for it.

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