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Editorial

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Preface to "Linear sequence, classification, synonymy, and bibliography of vascular plants: Lycophytes, ferns, gymnosperms and angiosperms"

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Organizing knowledge of the natural world into a system aids communication and helps us to understand better the organisms that surround us and upon which we depend. These classifications are often embedded in cultural and social systems, and in the past such "folk taxonomies" have been absorbed into scientific taxonomy. The basic function of words is that of naming (Lyons 1977), and in the human mind nothing really exists or can be communicated without a name.

Anything can be classified, but modern biological classification is different because it involves evolutionary relationships. Similarity between organisms placed in the same taxon is not arbitrary but is a result of shared descent from their common ancestor. Before the age of molecular phylogenetics, placement of organisms was based on morphological homology, but this can sometimes be deceptive (for example, Nelumbonaceae and Nymphaeaceae are aquatics and have superficially similar leaves, flowers and other features; they have previously been thought to be closely related, but molecular and detailed morphological data show they are not closely related at all).

Linear sequences of plant families are required by herbarium curators who wish to arrange collections systematically rather than alphabetically, and several herbaria are currently in the process of reorganising their collections, which requires linear classifications. Currently there is a wide range of systems in use, but as the understanding of relationships has changed, many of these classifications have become outdated and no longer represent the best estimate of relationships. To organise flowering plants systematically in floras, books, indices, check-lists, order beds (e.g. in botanical gardens) and listings on the internet, linear sequences based on resolved consensus classifications have also proven to be useful (Haston *et al.* 2007, 2009).

When a linear sequence is derived from branching phylogenetic trees, the order of taxa is dependent on the methodology used, and there is an inevitable loss of phylogenetic information. The linear sequences presented in this volume were derived from phylogenetic trees using the methodology described by Haston *et al.* (2007; even though this method was questioned by Hawthorne *et al.* 2008). In this method, clades with few taxa are placed before those with many taxa, which is of course an arbitrary choice.

This volume includes three articles, the first concerning lycophytes and ferns (Christenhusz *et al.* 2011a), the second providing a system for gymnosperms (Christenhusz *et al.* 2011b) and the third dealing with synonymy and bibliography of angiosperms (Reveal & Chase 2011).

Lycophytes and ferns. The classification of 'pteridophytes' has long been in flux. Species have been placed in a number of genera, moved from one family to another, and this has led to many taxonomists losing track of the currently accepted position of fern species. Recent classifications based on molecular data were a

great step forward, and the classification presented here in a linear fashion has incorporated information from existing classifications. In addition, a generic synonymy will aid future researchers on ferns to place their taxa correctly and will be useful in the reorganisation of herbaria and the production of checklists or online listings when different datasets need to be combined that have used different systems of fern taxonomy and classification. This study involves only extant lineages of ferns. In a group of great age in which fossil taxa are important in solving taxonomic relationships, we have to stress that this classification is still tentative and will need to be adjusted in the future if it is to accommodate the numerous extinct lineages, but most of the uses envisaged for such a list does not include fossil taxa.

Gymnosperms. A classification of gymnosperms is timely, due to the increase of our knowledge based on molecular data. In this article, an overview of extant gymnosperm families and genera is presented as a linear sequence with synonymy. This compilation is based on a number of molecular studies, and therefore it does not include any of the numerous fossil taxa, which will influence the correct placement of some of the extant lineages. As for ferns and lycophytes, future studies will need to include fossil taxa to tease out some nodes that cannot be resolved by molecular data and to place extinct lineages.

Angiosperms. A linear sequence for angiosperms (LAPG-III) is already available (Haston *et al*. 2009), and this is strictly followed here. The article presented here includes a few amendments based on recent research, notably the placement of genera that were treated as 'Taxa of uncertain position' in APG III (2009), but which have been placed in more recent studies. These are the three genera of Apodanthaceae, now placed in Cucurbitales (Filipowicz & Renner 2010), and *Petenaea* Lundell, now the sole member of the new family Petenaeaceae (Huerteales; Christenhusz *et al.* 2010). The two remaining genera incertae sedis are *Gumillea* Ruiz & Pav. (only known from a single old herbarium specimen; it may belong to Simaroubaceae), and *Nicobariodendron* Vasud & T.Chakrab (which most probably belongs to Celastraceae). The placement of *Pteleocarpa* is under re-examination with a new collection from Malaysia (R. Brummitt & M. Chase, personal communication).

Classifications are a record of the knowledge at a given time, and new findings will help us to improve these classifications in the future, although the ability to derive confidence limits on branches in phylogenetic trees and the ever-increasing ease of collecting DNA sequence data means that we are moving towards ever-more stable systems of classification. We hope that the linear classifications and synonymies presented here will find wide application and that many researchers in botany will find them useful.

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