Phylogeny, Character Evolution, and Biogeography of the Gondwanic Moss Family Hypopterygiaceae (Bryophyta)

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Abstract

Phylogenetic relationships among the seven genera of the Hypopterygiaceae, represented by 14 of the 21 species recognized in the family, were reconstructed based on variation in nucleotide sequences of six nuclear, mitochondrial, and plastid loci. Monophyly of the Hypopterygiaceae is strongly supported, whereas the genera *Cyathophorum* and *Dendrohypopterygium* are unambiguously polyphyletic. *Cyathophorum bulbosum* and *C. adiantum* make up a lineage sister to the remainder of the family. A lineage comprising four monotypic genera (*Arbusculohypopterygium*, *Canalohypopterygium*, *Catharomnion*, and *Dendrocyathophorum*) is sister to *Lopidium* plus a heterogenous clade that includes *Dendrohypopterygium*, *Hypopterygium*, *Cyathophorum hookerianum*, and *C. parvifolium*. The later two species are transferred to *Hypopterygium* as *H. hookerianum* and *H. parvifolium*. The Hypopterygiaceae are distinguished from their sister family, the Hookeriaceae, by their anisophylly, and by a border of two or more differentiated cells on lateral leaves, although this character also occurs in some Hookeriaceae and has been lost at least twice in the Hypopterygiaceae. Intermediate cells in the axillary hairs arose early in the evolution of the family but are lacking in the two species of *Cyathophorum* that form a sister group to the remainder of the Hypopterygiaceae.

Keywords: Bryophyta phylogenetics, Gondwana biogeography, Hookeriales, Hypopterygiaceae, *Hypopterygium*

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