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Phylogeny and diversification history of the large Neotropical genus *Philodendron* (Araceae): Accelerated speciation in a lineage dominated by epiphytes

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Abstract

Premise of the study: *Philodendron* is a large genus of ~560 species and among the most conspicuous epiphytic components of Neotropical forests, yet its phylogenetic relationships, timing of divergence, and diversification history have remained unclear. We present a comprehensive phylogenetic study for *Philodendron* and investigate its diversification, including divergence-time estimates and diversification rate shift analyses.

Methods: We performed the largest phylogenetic reconstruction for *Philodendron* to date, including 125 taxa with a combined dataset of three plastid regions (*petD*, *rpl16*, and *trnK/matK*). We estimated divergence times using Bayesian evolutionary analysis sampling trees and inferred shifts in diversification rates using Bayesian analysis of macroevolutionary mixtures.

Key results: We found that *Philodendron*, its three subgenera, and the closely related genus *Adelonema* are monophyletic. Within *Philodendron* subgenus *Philodendron*, 12 statistically well-supported clades are recognized. The genus *Philodendron* originated ~25 mya and a diversification rate upshift was detected at the origin of subgenus *Philodendron* ~12 mya.

Conclusions: *Philodendron* is a species-rich Neotropical lineage that diverged from *Adelonema* during the late Oligocene. Within *Philodendron*, the three subgenera currently accepted are recovered in two lineages: one contains the subgenera *Meconostigma* and *Pteromischum* and the other contains subgenus *Philodendron*. The lineage containing subgenera *Meconostigma* and *Pteromischum* underwent a consistent diversification rate. By contrast, a diversification rate upshift occurred within subgenus *Philodendron* ~12 mya. This diversification rate upshift is associated with the species radiation of the most speciose subgenus within *Philodendron*. The sections accepted within subgenus *Philodendron* are not congruent with the clades recovered. Instead, the clades are geographically defined.

Keywords: *Philodendron*; Araceae; Neotropics; divergence-time estimates; diversification rate shifts; museum and cradle models.

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