ACTA PALAEONTOLOGICA POLONICA

Phylogenetic relationships and time-calibration of the South American fossil and extant species of southern beeches (*Nothofagus*)

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Acta Palaeontologica Polonica 63 (4), 2018: 815-825 doi:https://doi.org/10.4202/app.00493.2018

The genus Nothofagus is considered as one of the most interesting plant genera, not only for the living species but also due to the fossil evidence distributed throughout the Southern Hemisphere. Early publications postulated a close relationship between fossil and living species of *Nothofagus*. However, the intrageneric phylogenetic relationships are not yet fully explored. This work assesses the placement of fossil representatives of genus *Nothofagus*, using different search strategies (Equal Weight and Implied Weight), and it analyses relationships with the extant species from South America (Argentina and Chile). The relationships of fossil taxa with the monophyletic subgenera *Brassospora, Fuscospora, Lophozonia,* and *Nothofagus* and the monophyly of the clades corresponding to the four subgenera are tested. A timecalibrated tree is generated in an approach aiming at estimating the divergence times of all the major lineages. The results support the inclusion of most fossil taxa from South America into the subgenera of *Nothofagus*. The strict consensus tree shows the following species as closely related: *Nothofagus elongata* + *N. alpina; N. variabilis* + *N. pumilio; N. suberruginea* + *N. alessandri; N. serrulata* + *N. dombeyi,* and *N. crenulata* + *N. betuloides*. The species *N. simplicidens* shares a common ancestor with *N. pumilio, N. crenulata,* and *N. betuloides* . This contribution is one of the first attempts to integrate fossil and extant *Nothofagus* species from South America into a phylogenetic analysis and an approach for a time-calibrated tree.

Key words: Fagales, *Nothofagus*, fossil, extant, phylogeny, time-scaling, Cenozoic, South America.

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