



# Diversity patterns of the vascular plant group Zosterophyllopsida

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## **Diversity patterns of the vascular plant group Zosterophyllopsida**

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Zosterophylls were prominent components of the Early Devonian Eophytic flora. However, the diversity studies of early vascular plants have paid little attention to the particular dynamics of this group. To address this concern, we prepared a relational database management system at the species-level to explore the fossil record of the Zosterophyllopsida. From this, a set of diversity metrics and sampling-corrected (so-called residual diversity) curves were used to analyze the temporal and spatial dimensions of palaeodiversity. Results highlight that the diversity dynamics of the Zosterophyllopsida is characterized by a sustained increase of species diversity from the Silurian-Devonian boundary to the end-Pragian followed by a large depletion during the Emsian and a small recovery phase in the Eifelian, after which only minor fluctuations are observed until the end-Devonian. Residual diversity reveals that both the heyday and the main fall of diversity are not driven by sampling. In addition, the taxic composition of five putative palaeophytogeographic units, Laurussia, Siberia, northwestern Gondwana, Kazakhstan and northeastern Gondwana (i.e. Australia, China and the Shan-Thai block) was compared. The high level of endemism shown by each unit confirms the phytogeographic differentiation and the occurrence of geographical barriers preventing massive floral exchanges between the corresponding regions for the Late Silurian-Early Devonian time interval. Statistical analyses were conducted on the three largest datasets, those corresponding to Laurussia, Siberia and northeastern Gondwana. New evidence indicates that the diversity dynamics of the group followed the same pattern in these regions, showing greatest diversity during the Pragian and sustained levels of extinction thereafter. By contrast, residual diversity reveals regional patterns. The radiation of the Zosterophyllopsida may have stopped earlier in northeastern Gondwana and Siberia than Laurussia. We propose that the onset of the extinctions resulted from the competitive replacement of the zosterophyllopsids by increasingly diversified lycopsids and basal euphyllophytes whose evolution would have been favoured by external factors, possibly the sea-level changes observed in the Pragian. This research was funded by Project ANR-2010-BLAN-607-02 "TERRES".