

**Abundant and diverse insect-mediated leaf damage in the middle-late Paleocene (58–60 Ma) Neotropical rainforests of the Bogotá Formation, central Colombia**

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Plant predation by insects is considered a major driver of high plant diversity in modern Neotropical rainforests. Nonetheless, the interactions between plants and their herbivores, and their role in the early evolution of Neotropical rainforests are poorly known. The earliest known records of Neotropical rainforests date back to the middle to late Paleocene of northern South America, and include the coastal-floodplain deposits of the Cerrejón Formation (58–60 Ma, Ranchería Basin, northern Colombia) and the lowland fluvial environments of a recently discovered flora in the Bogotá Formation (58–60 Ma, Sabana de Bogotá Basin, central Colombia). Previous reports of insect damage from Cerrejón show that herbivory was abundant but of low diversity, characterized by generalized feeders. Here, we studied insect damage in leaf fossils from the Bogotá flora, to test whether high abundance and low richness of insect damage typified early evolving Neotropical rainforests. The Bogotá flora records the highest richness and

frequency of insect damage associations among floras of comparable age in North America, Patagonia and Europe, in addition to the highest number of miner and galling associations. These results indicate that, by the middle-late Paleocene, insect herbivory was more intense and host-specialized in the Neotropical rainforests of the Bogotá flora than elsewhere, most likely reflecting a rich array of herbivorous insects. The high number of galls, a distinctive feature of the Bogotá flora, is consistent with the preferential use of canopy leaves by galling insects, as is seen in modern Neotropical rainforests. Furthermore, our results show differences in insect herbivory in Paleocene Neotropical rainforests, perhaps reflecting heterogeneous ecological recovery from the end-Cretaceous extinction, or alternatively that by the middle to late Paleocene there already were marked differences in the ecology of Neotropical rainforests. Insect herbivory in the Bogotá flora suggests a deep historical context for processes of negative density-dependence in Neotropical rainforests.