Submontane forests, their ecology, history and contribution to African biodiversity: what do ant/plant symbioses tell us?

D. McKey, C. Doumenge, C. Gonmadje, B. Senterre and G. Achoundong

Much work on the impact of past climatic fluctuations on the structure, distribution and genesis of biodiversity in Central Africa has focused on contrasts between rainforest and savannah biomes, and to a lesser extent on montane vs. lowland rainforests. Each of these biomes is characterized by different dominant plant taxa: grasses in savannahs, diverse tree species in lowland rainforests, and a relatively small number of tree species, distinct often at the familial level, in montane rainforests. These dominant taxa are in turn characterized by distinctive macro- and microfossils, and in the case of savannah and forest by different carbon isotopic signatures. Shifts in their distribution in space and time are thus evident in the fossil record. In contrast, much less is known about the historical biogeography of two more subtly contrasting kinds of communities, namely the lowland and submontane Guineo-Congolian rainforests. Floras and faunas of these two elevational zones include many related, but ecologically distinct, species, subspecies or ecotypes, and the broader application of molecular phylogeography is likely to reveal many further cases of cryptic genetic differentiation in relation to elevation. Whereas many submontane taxa have vicariant species essentially in lowland forests (e.g., *Allanblackia*, *Pterygota*, *Scaphopetalum*), some have more relatives at higher altitudes (e.g., *Ocotea*, *Syzygium*), suggesting different evolutionary histories. Pollen grains of related lowland and submontane plants are usually indistinguishable, and pollen spectra of lowland and submontane plant assemblages may be difficult to distinguish at best. Thus, the fossil record is largely silent on how climatic fluctuations have affected the distribution of lowland and submontane forests and their distinctive biodiversity, and palynologists and paleoecologists have accorded relatively little attention to the question. Nevertheless, this component of the biotic response to climatic change is most interesting in evolutionary terms, for its study often reveals speciation events that are recent, or even still in progress. After a brief review of biogeographical patterns in African submontane forests, we examine in detail how the different responses of ants to plants to elevational gradients has promoted the diversification of symbiotic ant/plant mutualisms within Guineo-Congolian rainforests, contributing to both the genesis of biodiversity (in speciation-engine “cradles”) and its preservation against extinction (in refugial “museums”).