Distribution and succession of vascular epiphytes in Colombian Amazonia

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Summary

EPIPHYTES ARE A CONSPICUOUS COMPONENT OF TROPICAL ECOSYSTEMS. Compared to trees, the epiphytic life-form appears particularly vulnerable to disturbance of the forest because their dependence on host plants. In this thesis, I quantified the species composition across the main landscapes and along a chronosequence of fallows in Colombian Amazonia, in order to ask: (1) how epiphyte diversity, abundance and distribution might differ between the principal landscapes units (Chapter 2), (2) how host-preferences might contribute to between-landscape epiphyte assemblages (Chapter 3), (3) if there is succession in epiphyte communities in fallows of different age (Chapter 4), and finally, (4) how hemi-epiphytes recruit along the gap-understory gradient (Chapter 5)?

Spatial patterns in epiphyte assemblages were the subject of the first part of the thesis. In Chapter 2, epiphyte species composition, which was recorded in thirty 0.025-m$^2$ plots, was related to the main landscapes units in the Metá area, situated in central part of the basin of the Caquetá river. This study comprised the first regional survey of vascular epiphytes in Colombian Amazonia. It found an unexpectedly strong association of epiphyte composition with the principal landscape units. In the study area, phorophyte occupancy levels were around 26-70%, which was substantially lower than the levels of 98% reported for floodplain forests near the Andes around Yasuní, Ecuador (Leimbeck and Balslev 2001). This led to the hypothesis that landscape-related differences in humidity and drought controlled the distribution of epiphyte species in absence of phorophyte limitation.

Chapter 3 focussed on the question how the composition of the phorophyte species might contribute to explaining patterns of epiphyte species
composition, as identified in ten 0.1-ha plots which were distributed over three main landscapes in Chiribiquete National Park, Colombian Amazonia. For both holo- and hemi-epiphytes the landscape effect on species composition strongly decreased when controlled for by the phorophyte composition in the plots. Phorophyte composition significantly explained epiphyte composition, and this effect was hardly removed after accounting for the landscape effect. Randomization tests yielded little evidence for host preferences.

The second part of the thesis addressed the re-establishment of the epiphyte community along a successional gradient in upland forests. In Chapter 4, holo- and hemi-epiphytes were studied in fifty-six 0.04-ha plots distributed in fallows of 2–30 y old and mature forests in Amacayacu National Park and Ticuna indigenous territory. The dynamics of the holo-epiphytes differed from that of the hemi-epiphytes. First, the hemi-epiphytes (which were mostly aroids) showed a remarkably higher abundance and biomass in the youngest fallows compared to the holo-epiphytes. Secondly, in the course of succession, the relative increase of holo-epiphytes exceeded that from secondary hemi-epiphytes. This suggested that, once established, the holo-epiphytes experienced no limits to local recruitment and growth within the expanding canopy of the developing fallows. Finally, the variation in species composition of holo-epiphyte species could not be related to time, whereas that from hemi-epiphytes was significantly associated to forest age, even after cancelling out any effect of the spatial configurations of the sampled plots. To explain the lack of succession in holo-epiphytes it was assumed that the increasing branch area in the expanding canopies in developing fallows yielded a growing supply of substrate, allowing a continuous arrival of new holo-epiphyte species. In contrast, the hemi-epiphytes, which occurred predominantly at tree bases, expansion in the developing fallows might be
increasingly limited by trunk space, potentially leading to species turnover due to competition.

The substantial densities of hemi-epiphytes in young fallows (Chapter 4) led to the questions raised in Chapter 5. By means of transect studies and field experiments we analyzed multiple recruitment pathways for secondary hemi-epiphytes in Amazonian forests (Amacayacu National Park). Rapid gap occupation may occur if plants, or fragments of plants, somehow survive the process of gap-creation and form new recruitments, either vegetatively or by means of seeds. We found little evidence for recruitment by seeds, even though some species produced numerous, highly viable seeds. High germination rates under shaded conditions suggested that seed recruitment is largely confined to closed-canopy forests. In contrast, we detected several traits in hemi-epiphyte aroids that improve their capacity to colonize gaps rapidly through vegetative recruitment. Firstly, stem cuttings of five species, which were experimentally placed in chagras, showed a sprouting capability, suggesting that aroid fragments may persist in gaps. Secondly, near the forest edges creeper plants with rapidly growing flagellar shoots were highly abundant, indicating that aroids were foraging for essential resources and dispersing meristems clonally. Finally, hemi-epiphytic aroids in the forest edge up to 30 m from the gaps exhibited habitat selection, growing towards the gap. These traits might help explain why the hemi-epiphytic arrivals in gaps were faster than holo-epiphytes, which depend mostly on seed dispersal.