Phytotaxa 166 (4): 259–272
www.mapress.com/phytotaxa/

Article

ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

http://dx.doi.org/10.11646/phytotaxa.166.4.2

Patterns of diversity and gaps in vascular (hemi-)epiphyte flora of Southwestern Amazonia

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Abstract

Vascular epiphytes are common in tropical forests and represent a considerable part of the biodiversity in Southwestern Amazonia. The aim of this study was to determine the floristic composition, patterns of species richness, and geographical distribution and knowledge gaps (collection effort) of the epiphytic vascular flora of the Brazilian State of Acre. We analyzed the database of the Flora of Acre and found a total of 331 species and 32 families of angiosperms and ferns. Almost half of the epiphytic flora of Acre (48% of species) occurs only in Northern Brazil. Of the total species, 56% are restricted to Amazonia. The distribution of the number of collections of epiphytes is concentrated in a few locations in the state and there is a positive correlation between the number of collections of epiphytes and the general index of collection density. The low and unequal sampling effort of epiphytes across the State, the high proportion of specimens identified at best to genus, and the still steep species/sampling curve indicates that the true diversity of epiphytes in Southwestern Amazonia is expressively higher than recorded thus far. This highlights the need for efforts specifically focused on documenting under-represented taxonomic groups as well as more thorough inventory of the canopy flora in this region of Amazonia.

Key words: Acre, biodiversity, canopy, epiphytes, tropical forest

Introduction

Tropical forests are well-known for harboring the richest terrestrial ecosystems on the planet (Gentry 1992). More than 18,000 plant species have been recorded for the Brazilian Amazon, compared to a total register to date of 33,000 for all of Brazil (Forzza *et al*. 2010, Forzza *et al*. 2012), but the total estimated Amazon flora will likely reach 40,000, of which 30,000 will be endemic (Mittermeier *et al*. 2003). This discrepancy between the totals, recorded and estimated, shows the enormous gaps that remain in the floristic inventory of Amazonia (Daly & Prance 1989, Silveira *et al*. 1997, Hopkins 2007).

Vascular epiphytes and primary hemiepiphytes, which may total more than 27,600 species in 73 families worldwide (Zotz 2013), comprise an important structural component of tropical forests (Gentry & Dodson 1987, Gentry 1988), where they may account for 30% of stand diversity (Kress 1986). Few studies have focused on epiphytes in Brazilian Amazonia (Gottsberger & Morawetz 1993, Obermuller *et al*. 2012), principally because access to the canopy is so difficult but also because most studies of diversity in Amazonia have focused on trees (Gentry 1992, Antonelli & Sanmartín 2011). Despite continuing gaps in sampling, it has already been documented that vascular epiphytes represent a considerable proportion of floristic diversity in Southwestern (SW) Amazonia; for example, they comprise 11% of the ca. 900 plant species recorded from Antimary State Forest in the State of Acre, Brazil (Euler *et al*. 2005). In another example, 77 species of vascular epiphytes were recorded from 90 trees marked and cut for timber in a forest management project; of these, 13 were new records for this state (Obermuller *et al*. 2012).

Accepted by Manuel Belgrano: 12 Mar 2014; published: 30 Apr. 2014

The biogeographic subdivisions of Brazil reflect very distinct biotic as well as abiotic characteristics, so those species occurring in several domains must possess high ecological flexibility (Mattos et al. 2004).

The overall abundance of epiphytes is determined less by temperature or precipitation (Aragão 1961) than by air humidity, so lower humidity coincides with lower epiphyte density and richness (Gentry & Dodson 1987). In Acre, another important factor is seasonality, as it presents a dry period of four months in some parts of the state (Acre 2000); such prolonged water stress is prohibitive to many epiphytes species. This partially explains why more than 50% of epiphytes in Acre for which habitat data are available have been collected along rivers and streams; one must also acknowledge that historically most travel in Acre, including for scientific expeditions, is by river.

The collection framework in the Acre indicates that the true diversity of epiphytes in this state is significantly higher than recorded thus far. Principal factors are the low and unequal collecting intensity of epiphytes across the state, the high proportion (> 50%) of specimens identified at best to the genus, and the still steep species/sampling curve, in which every six identifications of general collections yields a new species record for Acre on average (D. C. Daly, pers. observation). This situation highlights the need for efforts specifically focused on documenting under-represented taxonomic groups, such as Orchidaceae, as well as a more thorough inventory of the canopy flora in SW Amazonia, a region that continues to be deserving of intensified botanical attention.

Variation in collecting density among localities or municipalities can signal whether the flora of a given area is poorly or well-documented (Wanderley *et al*. 2011). The low number of epiphyte collections in some areas reflects difficulty of access to the canopy in those areas, where epiphytes are often overlooked unless explicitly sought; one way to improve documentation and representation of epiphytes is via projects whose mission is to collect living sterile material and cultivate them until they can be collected fertile (A.M. Amorim & R.C. Forzza, pers. comm.).

Acknowledgements

We thank the New York Botanical Garden and Universidade Federal do Acre program of collaborative research and all participating botanical specialists, as well as the Beneficia Foundation and JRS Biodiversity Foundation, which supported part of the work.

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