Electronic Supplementary Material

Fast diversification through a mosaic of evolutionary histories characterizes the endemic flora of ancient Neotropical mountains

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ESM – Literature review

Short literature review

As a first step in defining our sample of lineages, we performed a short literature review about the species diversity in the campo rupestre flora. This was necessary to understand what floristic elements are dominant in the area and what were the best model groups to test our hypotheses. Large-scale collaborative projects such as the Brazilian Flora 2020 (BFG, 2018) and recent reviews on campo rupestre biodiversity (e.g. Silveira et al. 2016; Fernandes, 2016; Colli-Silva et al. 2019) made this task easier.

To have a first understanding on the species diversity and floristic profile of the campo rupestre, we built a list of species occurring in the area by accessing the BFG website (floradobrasil.jbrj.gov.br), filtering for “native species only” and “occurs in campo rupestre” (“highland rocky fields”). The preliminary list resulted in 5065 species, for which 1999 are considered endemics (i.e. occur only in the campo rupestre), an endemism rate of c. 40%. We believe this endemism rate is also somewhat underrated: the rate of species description for the area has been fast and concentrated in the latest years (when many taxonomists have been focused on monographing groups from this region). Also, we believe that taxonomists who provide data for the Brazilian Flora 2020 often prefer not to define a taxon as endemic, rendering several possible endemic taxa a non-endemic status in this list. The list used here was produced on 30th of July 2018.

According to this list, the most diverse families in the campo rupestre are Asteraceae (625 species), Fabaceae (512 species) and Eriocaulaceae (495 species). Using the same list, the most diverse genera are Paepalanthus (Eriocaulaceae, 287 species), Chamaecrista (Fabaceae, 164 species) and Mimosa (Fabaceae, 127 species). When only endemic species are considered, the most diverse families are Eriocaulaceae (393
species), Asteraceae (256 species) and Melastomataceae (202 species). The most diverse endemic genera are *Paepalanthus* (Eriocaulaceae, 259 species), *Microlicia* (Melastomataceae, 108 species) and *Vellozia* (Velloziaceae, 99 species). A summary of this information is presented in Figure 1 below.

By contrasting both lists (occurrences and endemics), this data shows that, in general, *campo rupestre* lineages can be divided into two categories: those with high diversity but not necessarily high endemism (i.e. genera and families that appear among the 10 most speciose groups in the list of occurrence, but do not appear in the list of endemics; e.g. *Myrcia* and *Habenaria*). The other category includes those groups that are both highly diverse and highly endemic (i.e. genera and families that appear among the 10 most speciose in both lists; e.g. *Paepalanthus*, *Vellozia* and *Chamaecrista*). The first group contributes to the general diversity in the *campo rupestre*, but the lower endemism level implies lower specificity to this environment. The second group contributes to a high proportion of the species-richness in the *campo rupestre* flora and represents the “emblematic” *campo rupestre* radiations.

Figure 1: Most diverse families and genera in the *campo rupestre*. Numbers are according to the BFG database (accessed on the 30th of July, 2018).
Selection of model groups

We used the resulting list from the BFG search to look at the literature for groups where reasonably well-sampled phylogenetic trees were available. We selected groups according to the following criteria: (1) sample represents both woody and herbaceous flora (and both monocots and eudicots), (2) groups that are among both highly endemics and highly diverse (difference explained above) and (3) groups for which relatively well sampled phylogenetic trees were available in the literature (including campo rupestre endemics and their closest relatives from other areas). We selected 15 groups that matched those criteria. These are taxonomic verified, good quality phylogenetic trees made by taxonomists for purposes of taxonomic revisions and published in the last 10 years, thus being the most up to date state-of-the-art collection of campo rupestre phylogenetic trees.

The selected groups are:

- Monocots: Trimezieae (Iridaceae), Dyckia (Bromeliaceae), Cattleya (Orchidaceae), Paepalanthus (Eriocaulaceae), Habenaria (Orchidaceae) and the whole family Velloziaceae.
- Eudicots: Mimosa (Fabaceae), Neotropical Melastomateae (Melastomataceae), Lychnophorinae (Asteraceae), Diplusodon (Lythraceae), Marcetieae (Melastomataceae), Calliandra (Fabaceae), Myrcia (Myrtaceae), Chamaecrista (Fabaceae) and Minaria and allies (Apocynaceae).

These 15 phylogenetic trees cover 2872 tips before cleaning and 2099 species after cleaning, of which 309 occur and 753 are endemic to the campo rupestre. While it would be ideal to include some important lineages with a high proportion of diversity and endemism that still lack published phylogenetic trees (e.g. Xyridaceae and Microlicia), we estimate that this dataset represent over one-third of all the endemic species in the campo rupestre.

References:

Colli-Silva, M, Vasconcelos, TNC, Pirani, JR (2019) Outstanding plant endemism levels strongly support the recognition of campo rupestre provinces in mountaintops of eastern South America. Journal of Biogeography. (early view)