INTRODUCTION

Figure 1. Theoretical depiction of species geographic ranges (A) and respective ecological niches as defined by climatic variables E1 and E2 (B, C). The geographic region containing all occurrences of a species (circles in A) define the background environment (circles in B and C). Niche differences between species need to be interpreted in light of background environments. In B niche differences between species are less than expected from the background environment, while in C the opposite is true.

The phylogenetic niche conservatism hypothesis suggests that niche between species increase with phylogenetic distance. We tested the climatic aspect of this hypothesis, taking into account the background environment (Fig. 1). The hypothesis predicts that closely related species tend to overlap more in niche than distantly related species.

METHODS

Our study system was the plant genus Escallonia, containing 39 species of small trees and shrubs that occur in Neotropical mountains, along the Andes, and in highlands of Panama and southeastern Brazil. We characterized the ecological niche of these species based on known occurrences retrieved from the Tropicos® database and four climatic variables (Figs. 2, 3). We estimated ecological niche overlap between species with Schoener’s D, which ranges between 0 (no overlap) and 1 (complete overlap). For each species pair we also calculated 1,000 Schoener’s D values by randomly sampling background environments (Fig. 1), using R package “Ecospat”. We then calculated effect size of Schoener’s D as the difference between observed Schoener’s D and the mean of 1,000 Schoener’s D for the background environment. We also calculated standardized effect size of Schoener’s D as the effect size divided by the standard deviation of 1,000 Schoener’s D for the background environment.

RESULTS AND DISCUSSION

Figure 4. Panes A–C show niche overlap for species pairs within and among clades (defined by gray dots in Fig. 2). Panels D–F show respective null distributions of differences in niche overlap between species pairs within and among clades, calculated by randomizing species across the phylogeny (Fig. 2). Observed values shown as vertical dotted red lines.

We found support for the prediction that closely related Escallonia species tend to overlap more in niche space than distantly related species (Fig. 4). The results were similar for indices of niche overlap that ignore (Fig. 4A) and account for (Fig. 4B and C) differences between species in background environment. Ecological niche conservatism in Escallonia was higher than expected by background environments (Fig. 4A and B). Thus, it is not simply a reflection of spatial autocorrelation in climatic variables.

REFERENCES