Variation in the strength of local and regional determinants of herbivory across the Neotropics

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May 23, 2023

Abstract

Insect herbivory can vary from an inconsequential biotic interaction to a factor that contributes substantially to the diversity of plants and animals and overall interaction diversity. As herbivory is the result of numerous ecological and evolutionary processes, including complex population dynamics and the evolution of plant defense, it has been difficult to predict variation in herbivory across meaningful spatial scales. In the present work, we characterize patterns of herbivory on plants in a species rich and abundant tropical understory genus (Piper) across forests spanning 44° of latitude in the Neotropics. We modeled the effects of geography, climate, resource availability, and Piper species richness on the median, dispersion, and skew of generalist and specialist herbivory. By examining these multiple components of the distribution of herbivory, we were able to determine factors that increase biologically meaningful herbivory at the upper ends of the distribution. Site level variables such as latitude, seasonality, and maximum Piper richness explained variation in herbivory at the local scale (plot level) better for assemblages of Piper congeners than for a single species. Predictors that varied between local communities, such as resource availability and diversity, best explained the distribution of herbivory within sites, dampening broad patterns across latitude and climate and demonstrating why generalizations about gradients in herbivory have been elusive. The estimated population means, skew, and dispersion of herbivory responded differently to abiotic and biotic factors, illustrating the need for careful studies to explore distributions of herbivory and their effects on forest diversity. Nevertheless, we observed a roughly two-fold increase in median herbivory in humid compared to seasonal forests, and this finding aligns with the hypothesis that precipitation seasonality plays a critical role in shaping interaction diversity within tropical ecosystems.

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