Leaf Toughness in Tropical Rainforest Plants Depends on Leaf Age in Dicots but Not Monocots

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Plants defend themselves against attackers with a combination of chemical and physical defenses. A common feature of many plant species in lowland neotropical forests is a strikingly different color between new and mature leaves on the same plant, with young leaves often presenting with red or purple hues whereas mature leaves are dark green. This is true for both monocots (predominantly palm species) and dicots, leading to the hypothesis that young leaves are chemically but not physically defended. To test this, we collected new and mature leaves from 30 dicot species and 15 monocot species in a lowland tropical rainforest of the Peruvian Amazon. We measured leaf toughness (a measure of physical defense) with a leaf penetrometer three times on each leaf. Consistent with our hypothesis, young dicot leaves were significantly less tough than were their paired mature leaves. However, monocot leaves were remarkably tough independent of their age, with recorded toughness values exceeding 700 kPa (100 pounds per sq. inch) in some cases. These findings support the concept that young dicot leaves may invest heavily in chemical defenses to overcome limitations in physical defenses during leaf expansion as a means to deter herbivory, whereas monocot leaves invest immediately in physical defense. These divergent strategies may help shape plant communities in tropical forests.