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Study of the interspecific variability of mechanosensitivity on stem growth regulation in five neotropical rainforest species

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Abstract

In rain forests, saplings of shade-intolerant species are involved in a very challenging competition for height growth and access to light within the canopy. Indeed they are submitted to harsh photosynthetic constraints due to under-storey deep shade, and the stretch to the canopy is among the largest on Land.

Shade-intolerant species have thus to grow in height as fast as possible while avoiding stem buckling or breakage. Their survival thus depends on the regulation of the slenderness (height/diameter ratio) and stability of their saplings.

Different growth habits and biomechanical strategies have been observed among shade intolerant woody species. Trees display different amount of slenderness and buckling risks, whereas lianas overreach their buckling length while relying on other species for their support.

Mechanosensing of bending strains under chronic winds or self-weight, and consequent thigmomorphogenesis, were found crucial to control trunk size and slenderness according to the bending rigidity of the trunk and the loads it is been submitted to..

The present study investigates whether five different neotropical species with contrasting slendernesses and biomechanical strategies (*Eperua falcata*, *E. grandiflora*, *Tachigali melinonii*, *Symphonia globulifera* and *Bauhinia guianensis*) exhibit differences in mechanosensitivity

Defining quantitative and relevant thigmomorphogenetic traits requires a proper analysis of load distribution and biological signal integration within the stem, given that the species can display differences in size. This can be achieved through the Sum-of-Strain-Sensing model (S^3m) that has been validated on molecular and growth responses. The parameters of the dose-response curve between the applied sum of bending strains and the growth response define the mechanosensitivity of the plant in a size-independent manner.

Saplings were subjected to a regimen of controlled mechanical bending over a period of 2 months. Mechanical loading was controlled in terms of strains so that the species were subjected to the same range of sum of strains. Dose-response curves were then compared between tested species

Only one trait, the mechanosensing threshold displayed clear interspecific variation, with two clusters of species. Interestingly, the liana species *B. guianensis* exhibited a higher threshold than other Leguminosae species tested. This study provides a conceptual framework to study variability in plant mechanosensing and demonstrated interspecific variability in mechanosensing

Keywords

mechanosensitivity, trees, thigmomorphogenesis, growth strategies