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Bouldering: an alternative strategy to long-vertical climbing in root-climbing hortensias

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In the Neotropics, the genus *Hydrangea* of the popular ornamental hortensia family is represented by climbing species that strongly cling to their support surface by means of adhesive roots closely positioned along specialized anchoring stems. These root-climbing hortensia species belong to the nearly exclusive American *Hydrangea* section *Cornidia* and generally are long lianescent climbers that mostly flower and fructify high in the host tree canopy. The Mexican species *Hydrangea seemannii*, however, encompasses not only long lianescent climbers of large vertical rock walls and coniferous trees, but also short 'shrub-like' climbers on small rounded boulders. To investigate growth form plasticity in root-climbing hortensia species, we tested the hypothesis that support variability (e.g. differences in size and shape) promotes plastic responses observable at the mechanical, structural and anatomical level. Stem bending properties, architectural axis categorization, tissue organization and wood density were compared between boulder and long-vertical tree-climbers of *H. seemannii*. For comparison, the mechanical patterns of a closely related, strictly long-vertical tree-climbing species were investigated. *Hydrangea seemannii* has fine-tuned morphological, mechanical and anatomical responses to support variability suggesting the presence of two alternative root-climbing strategies that are optimized for their particular environmental conditions. Our results suggest that variation of some stem anatomical traits provides a buffering effect that regulates the mechanical and hydraulic demands of two distinct plant architectures. The adaptive value of observed plastic responses and the importance of considering growth form plasticity in evolutionary and conservation studies are discussed.

1. Introduction

Climbing plants show a wide range of highly specialized anchoring structures such as hooks, spines, tendrils, twining stems and adhesive roots that allow them to climb on a range of natural and artificial surfaces [1,2]. Different attachment methods provide different degrees of anchoring and confer particular mechanical properties to the plant growth form and life history [2,3]. In general,