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**Spectroscopy: an efficacious approach for better understanding of stress responses of Mediterranean plants**

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Recent advances in methods utilizing hyperspectral data have made it possible to estimate a variety of plant traits based on foliar optical properties, including nutrients, structure, secondary metabolites and overall physiological status. Plant traits are modelled as a function of reflectance features of leaves in the visible (VIS), near-infrared (NIR) and short-wave infrared (SWIR) spectral regions. The model calibration is accomplished by pairing spectra with reliable trait measurements and then validated by comparing relationships between observed and predicted values of independent samples. Models can then be used to predict the variable of interest in unknown samples on the basis of their spectral signature alone. Importantly, measurements of leaf optical properties are rapid, non-destructive, and relatively inexpensive and allowing for an increase in the number of plants sampled over multiple time periods under different environmental conditions, compared with standard collection techniques.

Here we present the results of a case of study where we used reflectance spectroscopy to characterize variation in leaf water potential (ΨLW) of *Quercus oleoides* plants from four regions of Central America (Belize, Costa Rica, Honduras and Mexico) exposed to differential water availability, and to test the ability to predict pre-dawn (PD) ΨLW *a posteriori* (approximately 5 hrs after PD measurements). We built predictive models for ΨLW using partial least-squares regression and then assessed the phenotypic plasticity (PP) of multiple leaf functional traits and spectral indices related to plant physiological activity.

Reflectance spectroscopy successfully estimated variation in ΨLW [97% of the models produced a high *R*2 (0.50-0.87), RMSE values (0.32-0.70 Mpa), %RMSE 8-20% of the data range, and 85% of the models showed minimal bias (-2.49-1.04)], as well as *a posteriori* predictions of PDΨLW [95% of the models having a *R*2 ranging between 0.50 and 0.79, RMSE values (0.27-0.59 Mpa), %RMSE 9-20% of the data range, and 83% of the models showed minimal bias (-2.45-1.05)]. Spectroscopic predictions of PDΨLW responded to water availability treatments similarly as reference measurements of PDΨLW. Mexican plants showed the highest PP value (plasticity index, PI = 0.102), followed by trees from Costa Rica (PI = 0.093), Honduras (PI = 0.075) and Belize (PI = 0.059). PP was generally higher for morphological traits, followed by physiological and biochemical traits in all plants except in Belizeans, where PP was higher for physiological traits. These findings demonstrate a promising approach for evaluation of Mediterranean plant responses to environmental change by providing rapid and cost effective estimates of variation in foliar functional traits.

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