Leaf-wax *n*-alkane $\delta^{13}C$ appears insensitive to available moisture

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The bulk carbon isotope ratio ($\delta^{13}C_{bulk}$) of leaves has long been recognized to vary with available moisture in C_3 but not C_4 plants. This has been attributed to the effects of water stress on stomatal conductance, and the reduction of the partial pressure of CO_2 inside the leaf (p_i) relative to the atmosphere (p_a), which influences carbon isotope fractionation by Rubisco in C_3 but not C_4 plants.

As a corollary, carbon isotope ratios of leaf-wax *n*-alkane ($\delta^{13}C_{lipid}$) would be expected to vary with available moisture in C_3 but not C_4 plants. However, this assumption has not been extensively tested. In order to examine whether $\delta^{13}C_{lipid}$ varies in parallel with $\delta^{13}C_{bulk}$ in relation to available moisture, we have compiled new and published data on $\delta^{13}C_{bulk}$ and $\delta^{13}C_{lipid}$ from C_3 and C_4 plants over a range of climatic conditions.

As expected, $\delta^{13}C_{bulk}$ demonstrates a significant dependance on potential evapotranspiration in C_3 but not C_4 plants. For C_3 plants, drier conditions correspond to more positive $\delta^{13}C_{bulk}$ values and wetter conditions correspond to more negative $\delta^{13}C_{bulk}$ values. In contrast, $\delta^{13}C_{lipid}$ values from these same C_3 plants show no dependence on potential evapotranspriation. In C_4 plants, $\delta^{13}C_{lipid}$ shows no significant relationship with potential evapotranspiration, similar to $\delta^{13}C_{bulk}$.

These results indicate that the fractionation of carbon isotopes between the bulk leaf and lipid ($\varepsilon_{l/bulk}$) is not constant in C_3 plants. In fact, it appears that $\varepsilon_{l/bulk}$ varies with available moisture in both C_3 and C_4 plants, with greater negative fractionation under drier conditions, and less negative fractionation under wetter conditions. In this dataset, the net result is that the variation in C_3 plant $\delta^{13}C_{bulk}$ with available moisture is compenstated by the opposite variation $\varepsilon_{l/bulk}$. As a consequence $\delta^{13}C_{lipid}$ appears to be insensitive to variations in available moisture. Variation in $\varepsilon_{l/bulk}$ within single species along climatic gradients is being examined to rule out the potential influence of plant type on the observed pattern.