1 November 2017

**Complex lignin composition identified in leaf tissues of the Canary Island date palm**

Unprecedented range of monolignol conjugates used in the lignification of Canary Island date palm leaf tissue.

**The Science**

We showed that Canary Island date palm (*Phoenix canariensis*) lignification uses an unprecedented range of monolignol conjugates, the distribution of which varies depending on the tissue region, indicating that they may play specific roles in the cell walls in these tissues and/or in the plant’s defense system.

**The Impact**

Understanding the plasticity of lignin biosynthesis, including identifying which monolignol conjugates are used in lignification in the wide variety of plant species available in nature, enables lignin valorization, both through extraction of naturally-occurring components and of compounds that have been engineered into bioenergy crops.

**Summary**

Here we show that the lignins in the cell walls of the leaf-base tissue regions from the Canary Island date palm have some of the most complex compositions reported to date. These lignins derive from the traditional monolignols and an array of monolignol (ML) conjugates (ML-acetate, ML-benzoate, ML-*p*-hydroxybenzoate, ML-*p*-coumarate, ML-vanillate, and ML-ferulate). These ML conjugates are not evenly distributed throughout the tissue regions of the leaf base but show some tissue region specificity. Most notable are the higher levels of ML-*p*-coumarate in lignins from the outer tissue region and ML-benzoate in lignins from the inner tissue region. To our knowledge, this is the first plant species that has been shown to contain ML-benzoate and ML-vanillate incorporated into its lignin. The discovery of ML-benzoate and ML-vanillate incorporation into lignin further expands the growing list of carboxylic acids known to acylate monolignols via their γ-hydroxyl groups and that have been confirmed *in planta* to participate in cell wall lignification. The presence of so many different monolignol conjugates further demonstrates the plasticity of lignification, the diversity of lignin subunits, and the chemical complexity of the lignin polymer, but also enhances our ability to derive value from lignins.

**Contacts (BER PM)**

N. Kent Peters
Program Manager, Office of Biological and Environmental Research
kent.peters@science.doe.gov, 301-903-5549

**(PI Contact)**

John Ralph
University of Wisconsin - Madison
jralph@wisc.edu

**Funding**This research was supported by the DOE Great Lakes Bioenergy Research Center (DOE Office of Science BER DE-FC02-07ER64494).

**Publications**

Karlen, S. D. *et al.* “Highly decorated lignins in leaf tissues of the Canary Island date palm *Phoenix canariensis*.” *Plant Physiology* 175, 1058-1067 (2017) [DOI: 10.1104/pp.17.01172].

**Related Links**

<http://www.plantphysiol.org/content/175/3/1058>

**PM Recommendation for SC Web Publication**