The two DUF579 domain-containing proteins IRX15 and IRX15-L are involved in xylan biosynthesis and influences the length of the formed xylan polymers

Jensen, J.K.[1,3]; Kim, H.[2,3]; Cocuron, J.C.[1,3]; Orler, R.[1,3]; Ralph, J.[2,3]; Wilkerson, C.G.[1,3]

1 - Michigan State University, East Lansing, MI, USA; 2 - University of Wisconsin, Madison, WI, USA; 3 - DOE Great Lakes Bioenergy Research Center

Xylan is the principal hemicellulose in the secondary cell walls of eudicots and in the primary and secondary cell walls of grasses and cereals. The biosynthesis of this important cell wall component has yet to be fully determined although a number of proteins have been shown to be required for xylan synthesis.

To discover new genes involved in xylan biosynthesis we explored the psyllium (*Plantago ovata Forsk*) seed mucilaginous layer through EST profiling. This tissue synthesizes large amounts of a complex heteroxylan over a short period of time. By comparing abundant transcripts in this tissue with abundant transcripts specifically present during secondary cell wall formation in *Arabidopsis thaliana*, where glucuconoxylan biosynthesis is pronounced, we identified several Arabidopsis genes likely involved in xylan biosynthesis. Two of these genes encode proteins containing a Domain of Unknown Function (DUF) 579 and were designated *IRREGULAR XYLEM* (*IRX*) *15* and *IRX15-LIKE* (*IRX15-L*) (1;2).

We obtained Arabidopsis T-DNA knockout lines for the two genes and analyzed their lower stems for changes in neutral monosaccharide composition. No changes were observed in each of these mutants, although the *irx15 irx15-L* double mutant displayed a moderate reduction in stem xylose. Further characterization of the *irx15 irx15-L* mutant revealed irregular secondary cell wall margins in fiber cells and a lower xylan degree of polymerization. Through these studies we conclude that *IRX15* and *IRX15-L* function in a redundant manner and are involved in xylan biosynthesis in particular the control of the length of the polymer (1).

References:

1. *Jensen JK, Kim H, Cocuron JC, Orler R, Ralph J, Wilkerson CG (2011) Plant J. 66; 387*

2. *Brown D, Wightman R, Zhang Z, Gomez LD, Atanassov I, Bukowski JP, Tryfona T, McQueen-Mason SJ, Dupree P, Turner S (2011) Plant J. 66; 401*

This work is supported by DOE Great Lakes Bioenergy Research Center