LIGNIFICATION

Cytosolic engine

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Lignin is one of the key components in plant cell walls, especially in the vascular and supporting tissues. The biosynthesis of lignin monomers starts in the cytosol and involves a series of cytochrome P450 enzymes, such as *p*-coumaroyl shikimate 3'-hydroxylase (C3'H) and cinnamate 4-hydroxylase (C4H). Recently, Richard Dixon's group at the University of North Texas, USA, reported the biological role of coumarate 3-hydroxylase (C3H) and its similarity/divergence between *Arabidopsis* and a grass model, *Brachypodium*.

Cell wall components and biosynthesis differ in different plant species. For instance, caffeoyl shikimate esterase (CSE), which converts caffeoyl shikimate to caffiate for lignin monomer biosynthesis, is important in eudicot species like *Arabidopsis* and *Medicago*; however, CSE orthologues are lacking in many grass species. In this study, Barros et al. proposed that an alternative route exists to substitute the function of CSE and characterized C3H, a cytosolic

cytochrome P450, in both monocot and eudicot species. C3H showed dual enzymatic activity, as 4-coumarate hydroxylase and ascorbate peroxidase. They analysed a *Brachypodium* mutant with reduced C3H levels and activity, which showed accumulation of 4-coumarate and less lignin synthesis compared to the wild-type control. In *Arabidopsis*, *c3h1* knockdown mutant showed no detectable phenotypes. However, the *cse2 c3h1* double mutant is embryonic lethal, suggesting the essentiality of CSE and C3H. Although further investigations could help to validate the physiological roles of different C3H activities, current evidence has suggested interesting and novel insights of lignin biosynthesis in both monocot and eudicot species.

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