**CGR2 and CGR3 are likely methyltransferases critical for pectin methylesterification and plant growth**

By providing mechanical strength and enabling reception and transmission of developmental and environmental cues, the plant cell wall serves as a critical interface between the protoplast and the surrounding environment. The diverse roles of the cell wall are maintained by a complex yet dynamic combination of lignin and polysaccharides, which comprise cellulose, hemicellulose, pectin and lignin. Pectins are critical polysaccharides of the cell wall that are involved in key aspects of a plant’s life, including cell-wall stiffness, cell-to-cell adhesion, and mechanical strength. Pectins undergo methylesterification, which affects their cellular roles. Pectin methyltransferases are believed to methylesterify pectins in the Golgi, but little is known about their identity. To date, there is only circumstantial evidence to support a role for QUASIMODO2 (QUA2)-like proteins and an unrelated plant-specific protein, cotton Golgi-related 3(CGR3), in pectin methylesterification. To add to the knowledge of pectin biosynthesis, here we characterized a close homolog of CGR3, named CGR2, and evaluated the effect of loss-of-function mutants and over-expression lines of CGR2 and CGR3 *in planta*. Our results show that, similar to CGR3, CGR2 is a Golgi protein whose enzyme active site is located in the Golgi lumen where pectin methylesterification occurs. Through phenotypical analyses, we also established that simultaneous loss of CGR2 and CGR3 causes severe defects in plant growth and development, supporting critical but overlapping functional roles of these proteins. Qualitative and quantitative cell-wall analytical assays of the double knockout mutant demonstrated reduced levels of pectin methylesterification, coupled with decreased microsomal pectin methyltransferase activity. Conversely, CGR2 and CGR3 over-expression lines have markedly opposite phenotypes to the double knockout mutant, with increased cell-wall methylesterification levels and microsomal pectin methyltransferase activity. Based on these findings, we propose that CGR2 and CGR3 are critical proteins in plant growth and development that act redundantly in pectin methylesterification in the Golgi apparatus. This knowledge may inform the design of new bioenergy crops with altered cell wall properties that may have improved bioenergy production.

**References:** Kim, S.-J., Held, M. A., Zemelis, S., Wilkerson, C, Brandizzi, F. (2015) CGR2 and CGR3 have critical overlapping roles in pectin methylesterification and plant growth in *Arabidopsis thaliana*. The Plant Journal **82**, 208-220.

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