Identifying Genes Responsible for Suberin Synthesis and Regulation and Determining the Effects of Water Stresses on Exodermal Development in Tomato

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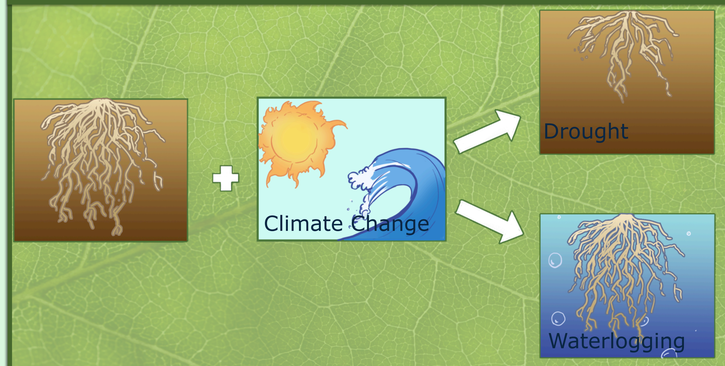
Effects of Water Stresses on Root System



Elucidating Suberin Genetics

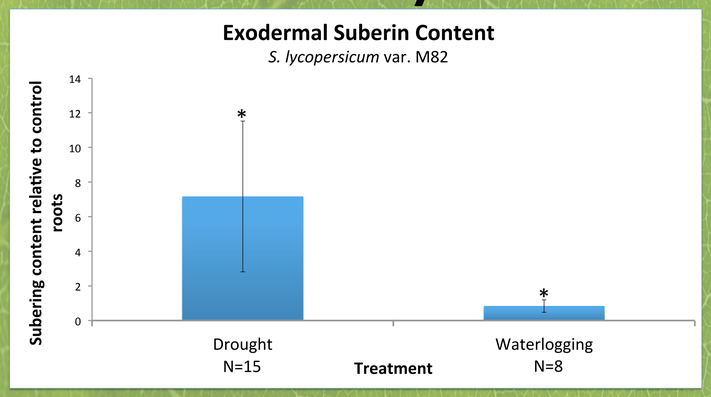
Biological Question

What are the genes responsible for suberin biosynthesis and regulation?

Methods

- CRISPR/Cas9 system (Fig. 1) to create nonsense mutations in candidate genes.
- Hairy root transgenics (Fig. 2) to create transgenic roots.
- Confocal Microscopy (Fig. 3) to quantify mutation effects in plants.

Preliminary Data



Citations

1. M. Ron *et al., Plant Physiology* 165:*755* (2013)
2. J. Graca *et al., Front. Chem (2015)*
3. *Glazer, A. W., and Nikaido, H. (1995). Microbial Biotechnology: fundamentals of applied microbiology. San Francisco: W. H. Freeman, p. 340*

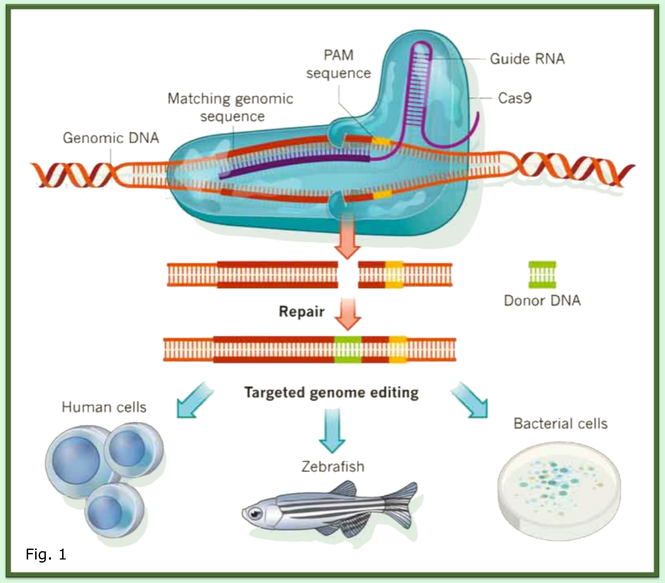


Fig. 1

CRIPSR/Cas9 system can be used to generate nonsense mutations in target genes.

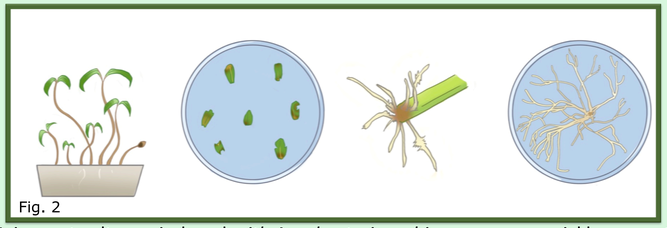


Fig. 2

Hairy root cultures, induced *with Agrobacterium rhizogenes*, can quickly generate transgenic roots

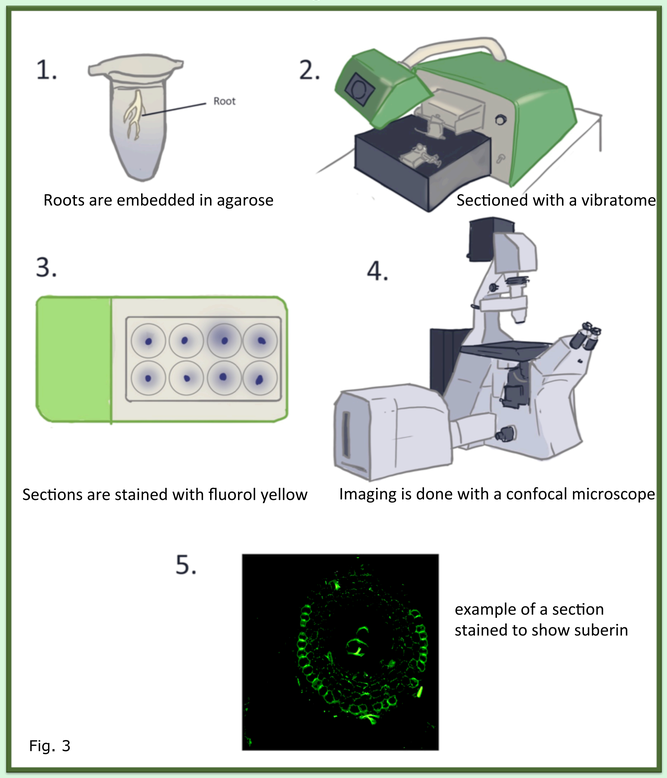


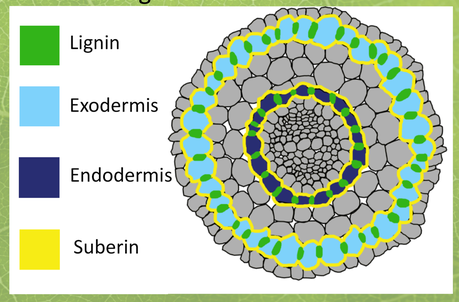
Fig. 3

Tomato Exodermis

We are comparing a cultivated tomato to a wild drought tomato

Solanum lycopersicum var. M82

Solanum pennellii



Tomato root cross section with exodermis and endodermis cell layers highlighted

Effects of Water Stresses on Exodermis

Biological Questions

What is the exodermal composition in the different root zones in terms of lignin and suberin? How is it altered in the face of water stresses such as drought and waterlogging?

Methods

Location and concentration of lignin and suberin in the different root zones (Fig. 4) will be characterized by confocal microscopy and analyzed with ImageJ (Fig. 3).

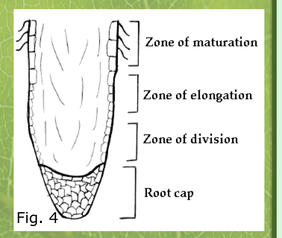
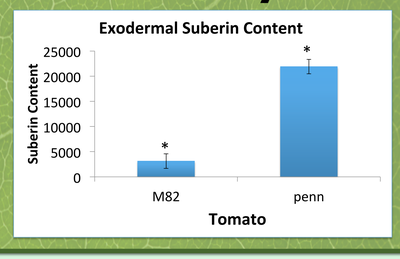


Fig. 4

Root zones

Preliminary Data



Drought tolerant S. pennellii has constitutively higher exodermal suberin content

Conclusion

The molecular mechanisms underlying tomato exodermis development have never been studied. This work has the potential to change our understanding of how tomatoes can alter cell type development with specific modifications to handle water stress.