The Effects of Waterlogging and Drought on Aerenchyma Formation in Tomato

Niba Audrey Nirmal, Kaisa Kajala, Donnelly West, Siobhan Brady

Departments of Plant Biology and Genome Center.

1. Flooding Induces Aerenchyma in Tomato

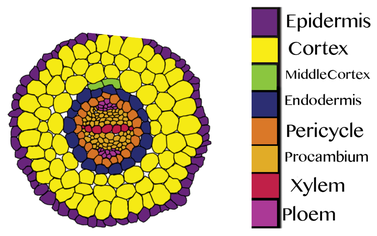
Climate change → crop waterlogging → less oxygen diffusion into soil → stops root respiration

Plant Response includes formation of

- hypocotyl derived roots
- aerenchyma in cortex layer for oxygen diffusion

Biological questions

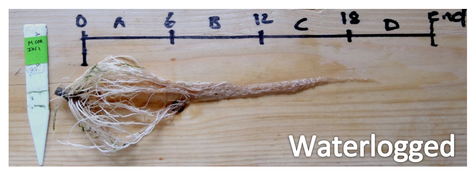
- Can tomatoes survive water stresses by hypocotyl-derived roots or aerenchyma?
- Can hairy root cultures form aerenchyma?



2. Tomato Hypocotyl-Derived Roots

Solanum lycopersicum

- is a model crop plant
- has a sequenced genome
- is transformable

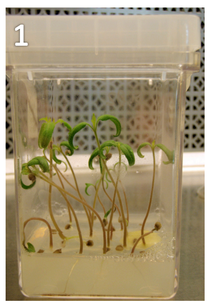


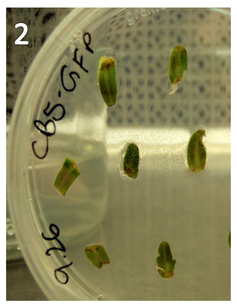
Drought: Given no water
Control: Given nutrient water
Waterlogged: Given extra water and placed on a plastic container to prevent drainage.

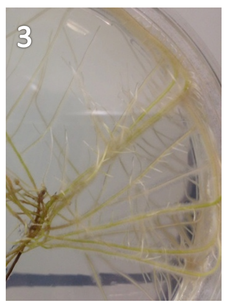
3. Transgenic Hairy Root Cultures

Agrobacterium rhizogenes causes hairy root disease, but can also quickly make transgenic roots.

1. Vector integrated into bacteria.
2. Bacteria and tomatoes grown together.
3. T-DNA in bacteria incudes hairy root growth.



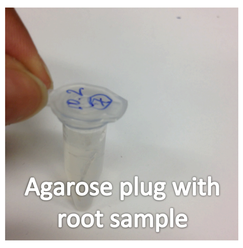


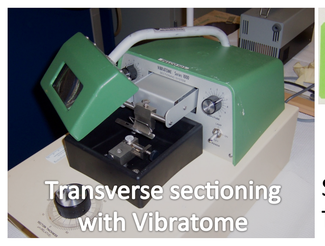


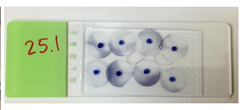
4. Submergence and Sectioning

Submergence Trials

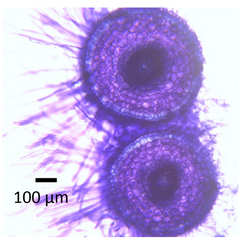
Sectioning



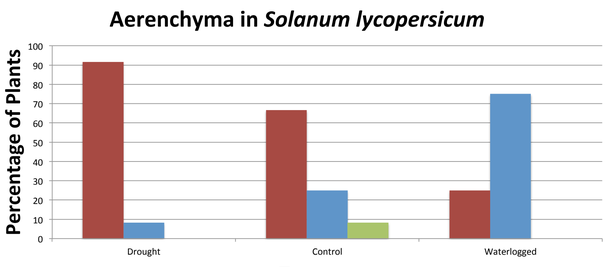




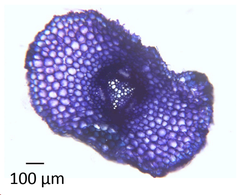
Staining with Toluidine Blue



5. Aerenchyma does not Readily Form in Cultivar M82 and Absent in Hairy Roots

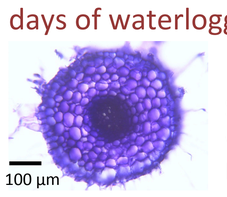


After being grown for 14 days, plants were subjected to experimentation for 12 days, with 12 plants per treatment. Tissue was taken from the closest cm to stem, with a minimum length of 1 cm.



Section from a waterlogged M82 hypocotyl-derived root.

None of the Hairy Root cultures formed aerenchyma after 7 days of waterlogging stress.



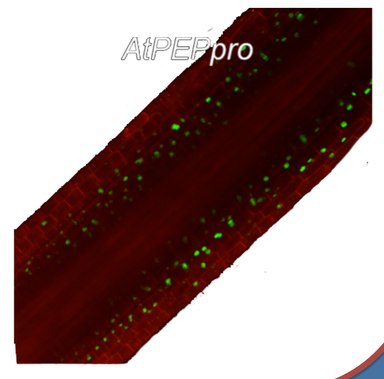
Section from a waterlogged Hairy Root.

6. Future Research Into Genetics

Cortex cells

- have been connected to drought responses
- form aerenchyma

I can determine the genetic differences within these cells with cortex-specific nuclear and ribosomal tags.



Brady Lab

Plasticity Project

Contact Information

Funding