How to Catch a Cereal Killer

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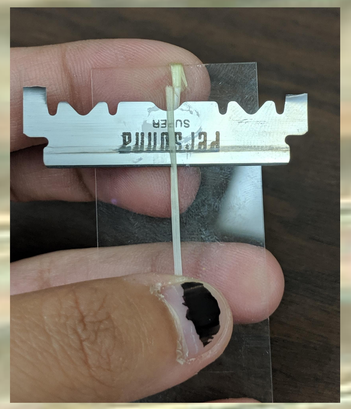
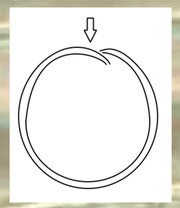
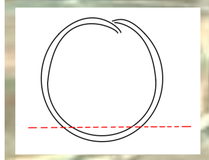
Blast disease in **ryegrass** is **similar** to **rice** blast in regard to infection **cell biology**.

INTRO:

- *Magnaporthe oryzae* has been devastating to various grasses. This is especially true in food crops around the globe.
- Resistance has been implemented but has not been completely successful due to the variability of the fungus. It is hypothesized that this is due in part to the presence of disposable mini-chromosomes.
- Ryegrass blast pathogen is closely related to the dangerous, emerging wheat blast pathogen, and understanding it can help us understand wheat blast as well as pathogen variability.
- The ryegrass pathogen on its own recently emerged as a serious threat to golf courses and sports fields in the U.S.
- Hypothesis: The ryegrass pathogen uses the same biotrophic (live-cell) invasion strategy as the extensively-studied rice blast pathogen.



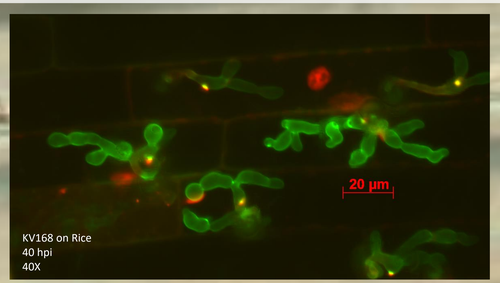


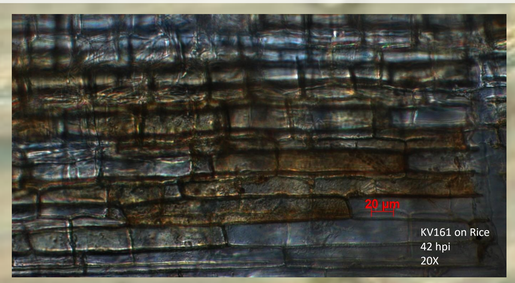


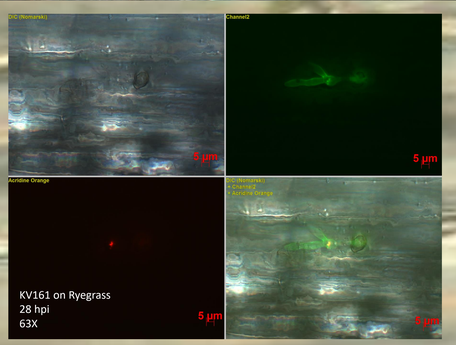
METHODS

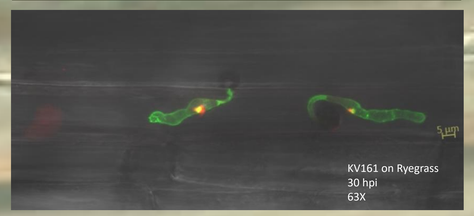
1. Develop a method to image the fungus invading ryegrass sheath epidermal cells.
2. Compare how KV168 (rice pathogen) and KV161 (ryegrass pathogen) invade their host and secrete extracellular fluorescent effector proteins (BAS4: GFP) and cytoplasmic fluorescent effector proteins (PWL2:mCherry:NLS) using wide-field and confocal fluorescent microscopy.
   - Plants used: Gulf Annual Ryegrass and YT16 (rice)
   - Strains used: KV157, KV161, and KV168
3. Performed Agrobacterium-Mediated transformation of ryegrass pathogen G245 with a plasmid containing the genes for fluorescent effectors BAS4: GFP and PWL2:mCherry:NLS.

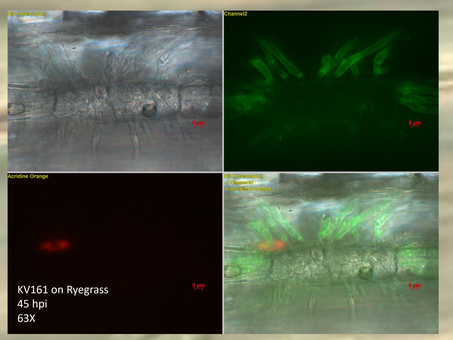
RESULTS

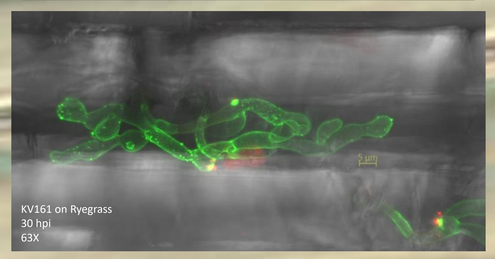


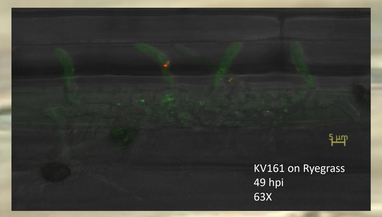


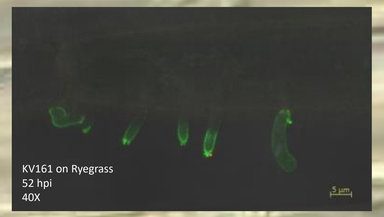












CONCLUSIONS

- The ryegrass pathogen has a host invasion strategy that is similar to the well-studied rice pathogen.
  - BICs, 2° cell invasion, special invasive hyphae
- Ryegrass pathogen KV161 did not penetrate rice plants due to hypersensitive resistance.
- Ryegrass sheath assay works best when the plant is about 5 – 6 weeks old.
- Ryegrass live-cell imaging is optimal with water objective lenses.

FUTURE DIRECTIONS

- Viewing new and emerging ryegrass pathogens.
- With changing climates, the blast pathogen has been able to make host jumps (Brazil and Kentucky). Studying the ryegrass pathogen will allow us to prevent/control these host jumps.
- Studying ryegrass pathogens that have the dispensable mini-chromosomes (i.e. strain G245) microscopically and genetically to attain a refined understanding of mini-chromosomes in pathogenicity.
- Further studying of the ryegrass pathogen will allow us to understand the wheat pathogen which can only be studied in a level three biocontainment facility to prevent of introduction of the pathogen into the U.S.

ACKNOWLEDGEMENTS

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Take a picture to see supplementary information