

Background

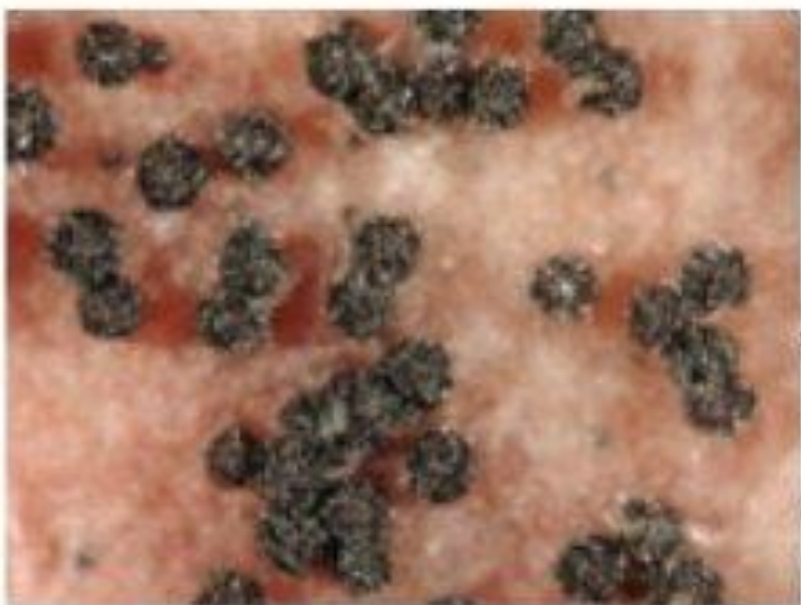
- Fusarium graminearum* is a fungal pathogen of cereal crops such as wheat, in which it causes bleaching on the seed heads
- It causes yield loss in infected crops and produces mycotoxins, such as deoxynivalenol (DON), that are harmful to humans and livestock
- Ascospores are primary way that *F. graminearum* starts a new infection
- Perithecia are the fruiting bodies of the fungus that produce the ascospores
- F. graminearum* is a homothallic fungus, meaning it can self-fertilize and reproduce without a compatible partner



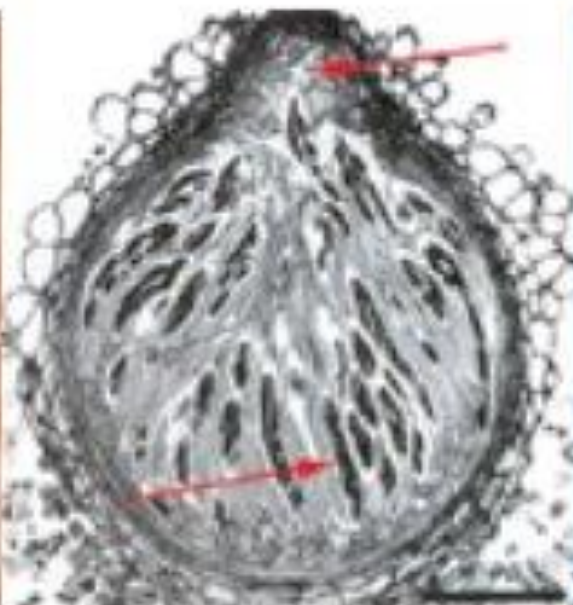
Bleaching on wheat caused by *F. graminearum*



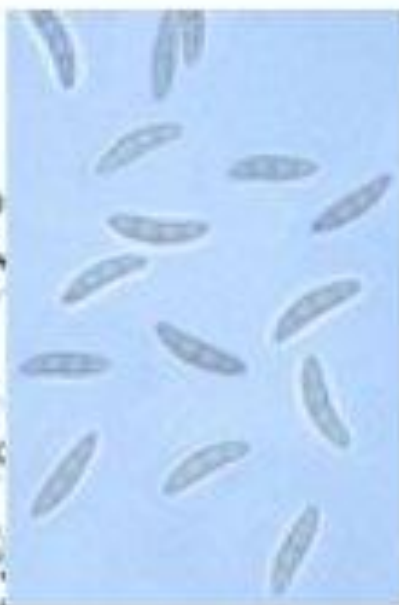
Normal and shrunk grains



Perithecia under low magnification



Perithecia under high magnification

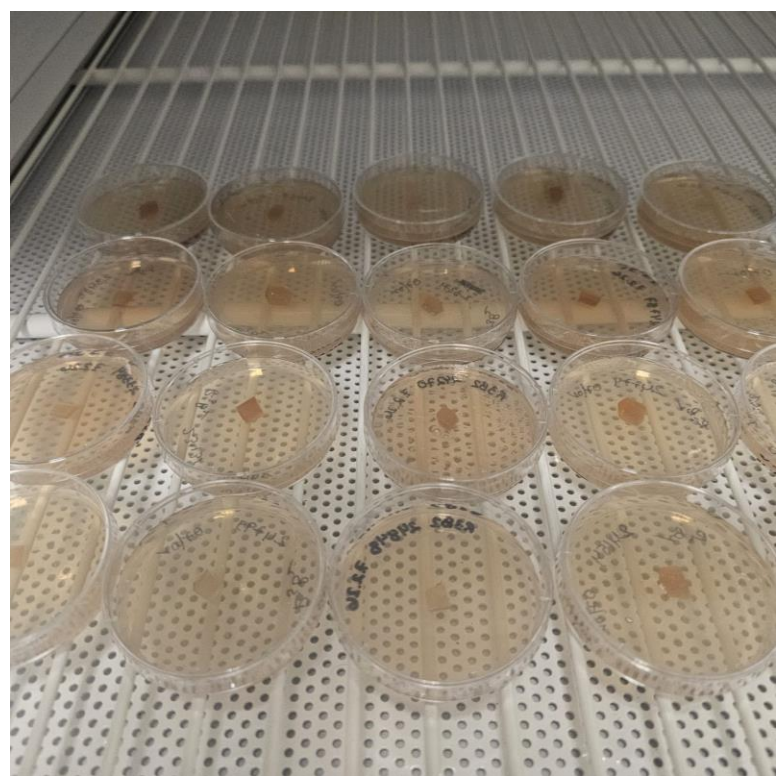


Ascospores under high magnification

Objective

- Characterize the production of perithecia and ascospores from various isolates in the NA1 and NA2 populations of *F. graminearum***

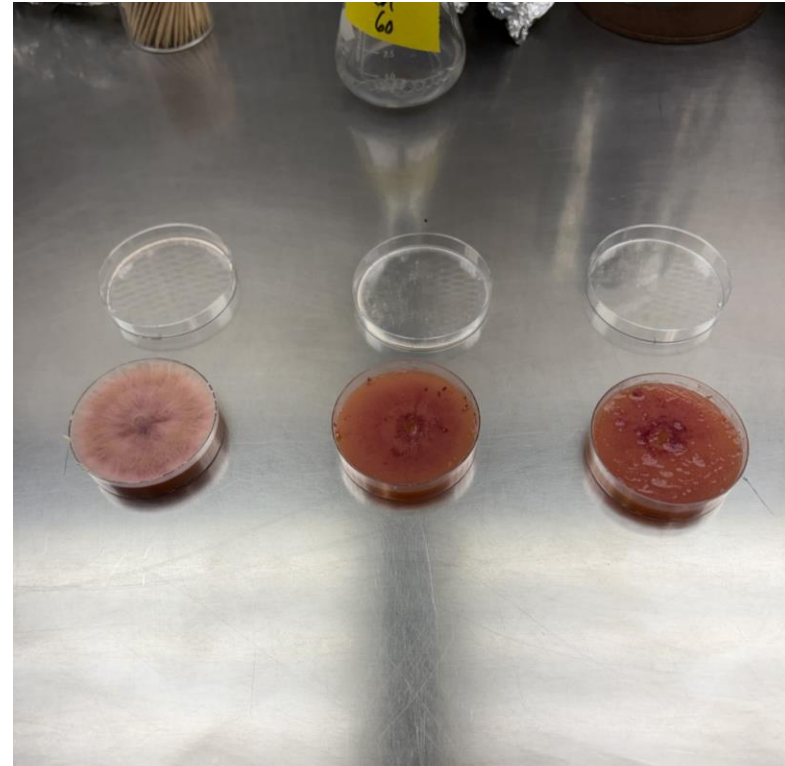
Methods



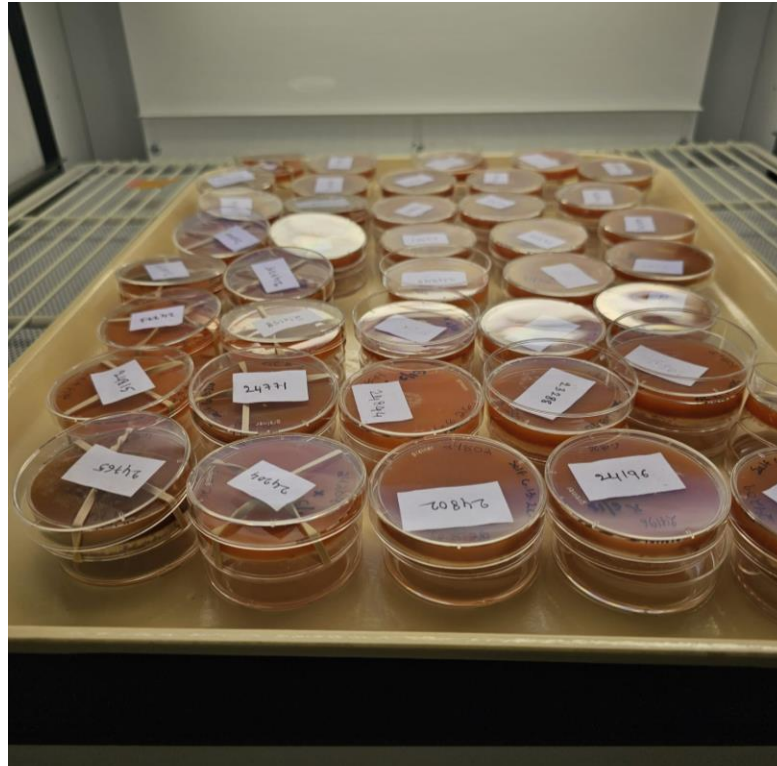
- Isolates are grown on mung bean agar



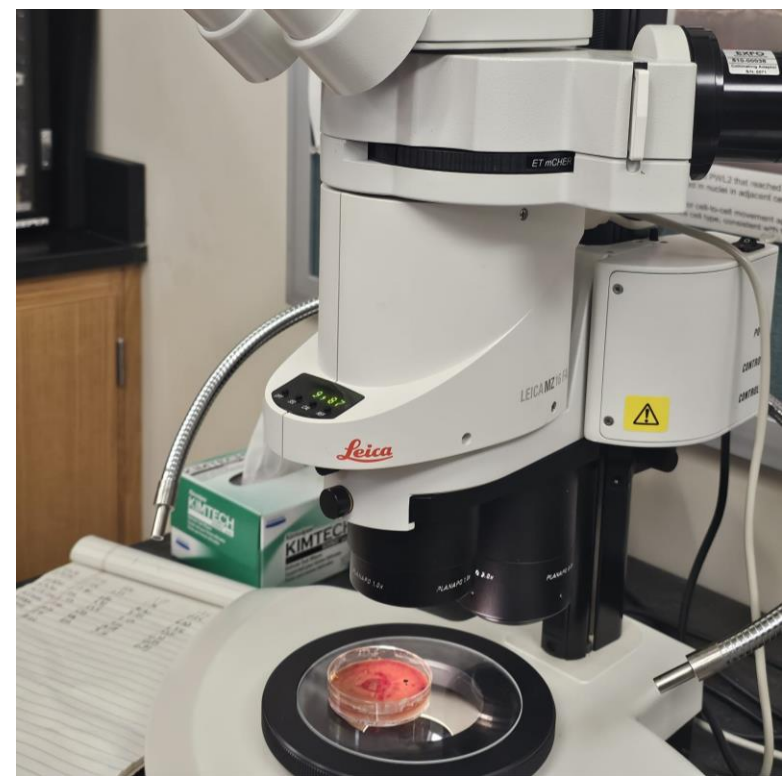
- After 4-6 days plugs are moved to carrot agar



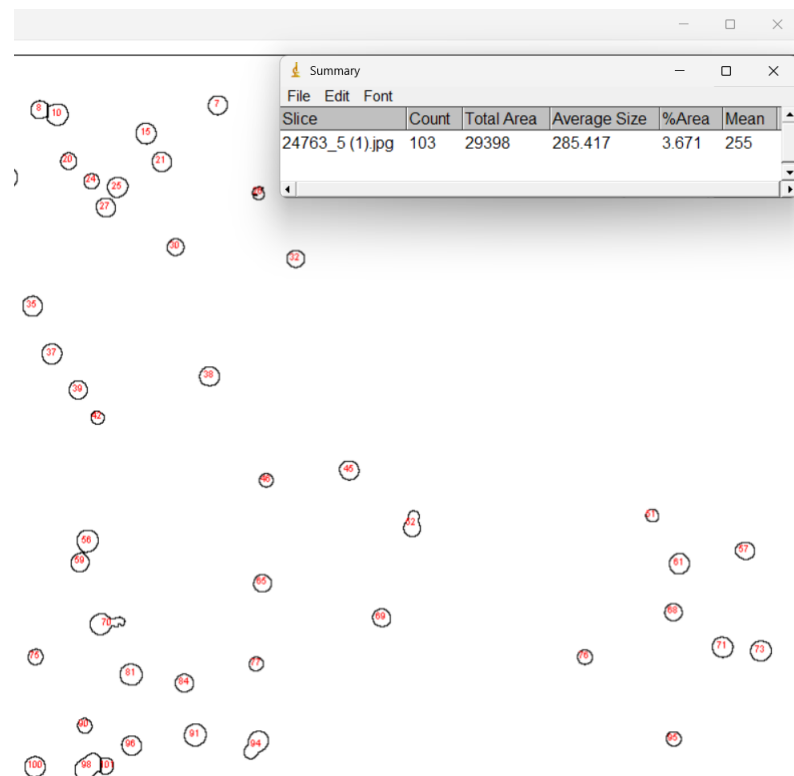
- Once mycelia cover plate, fungus is self-fertilized



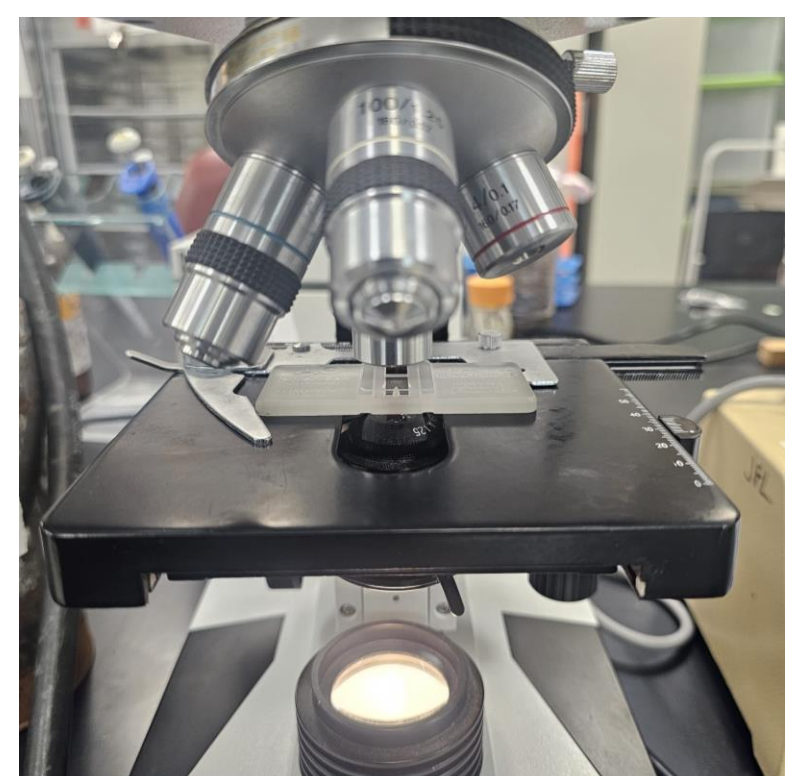
- Ascospores are collected on 8th-10th days post fertilization



- To count amount of perithecia, pictures of plates are taken on the 8th day



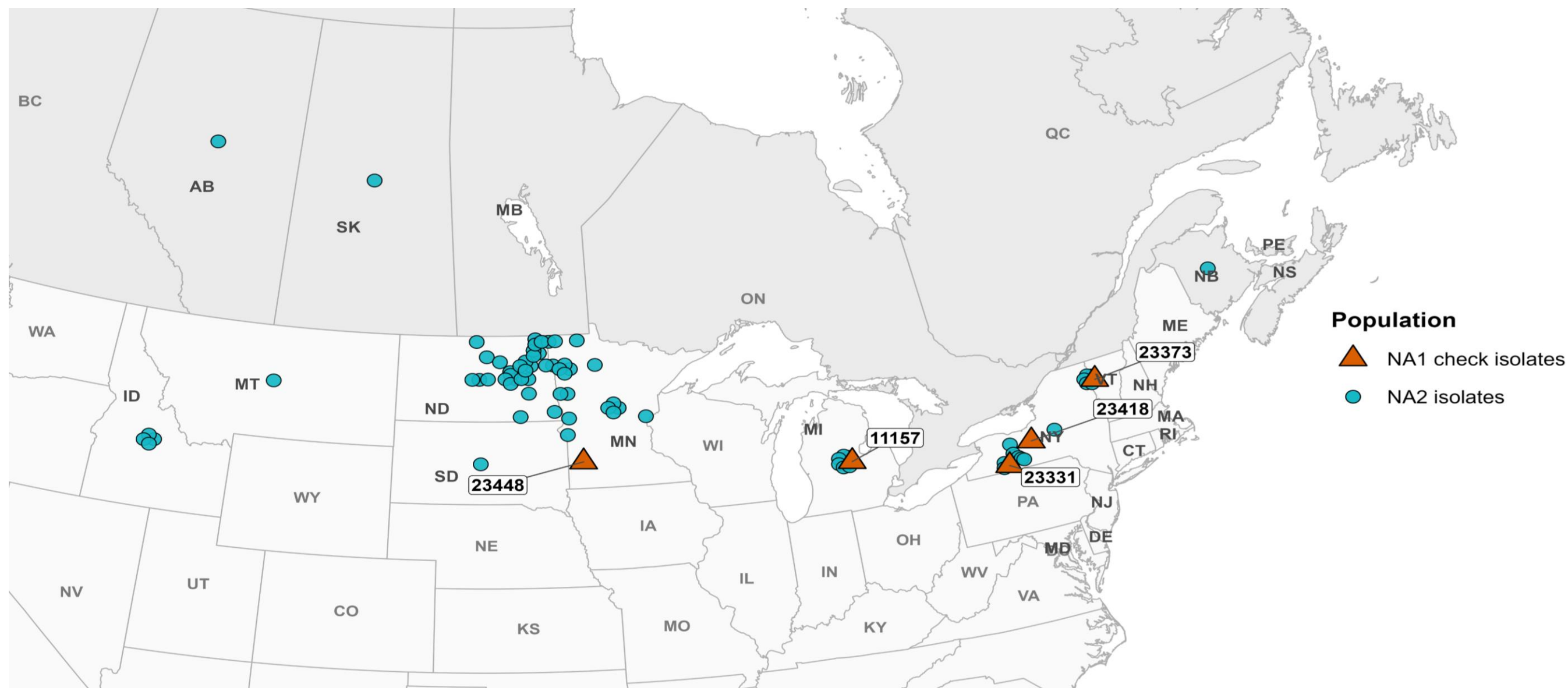
- ImageJ software was used to count perithecia



- Ascospores are counted using a microscope and hemocytometer



- Hemocytometer used to count spores

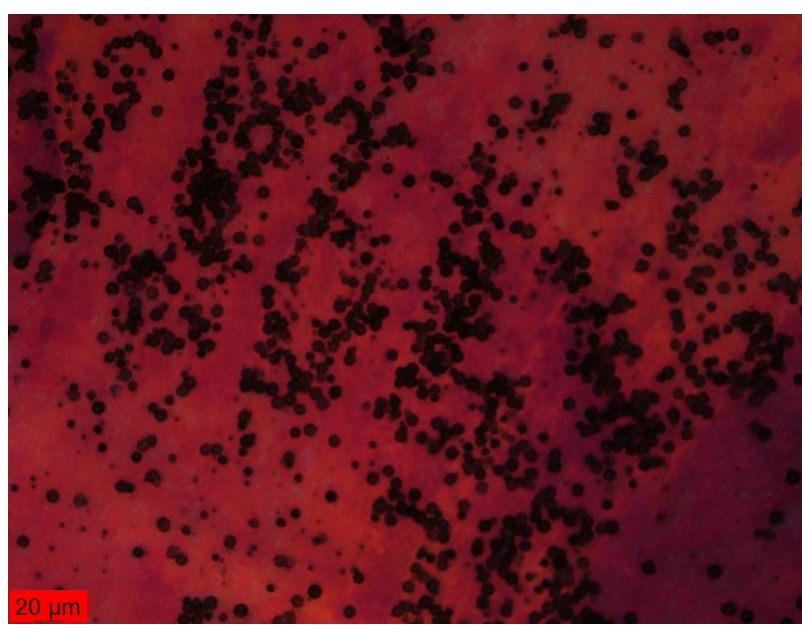


Map showing where isolates used in this experiment were collected.

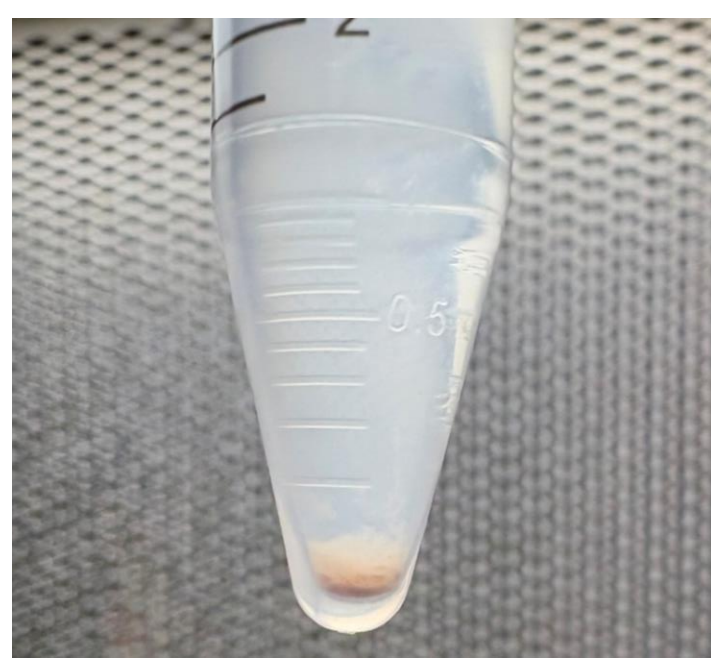
Results



Plate showing perithecia from isolate 23448



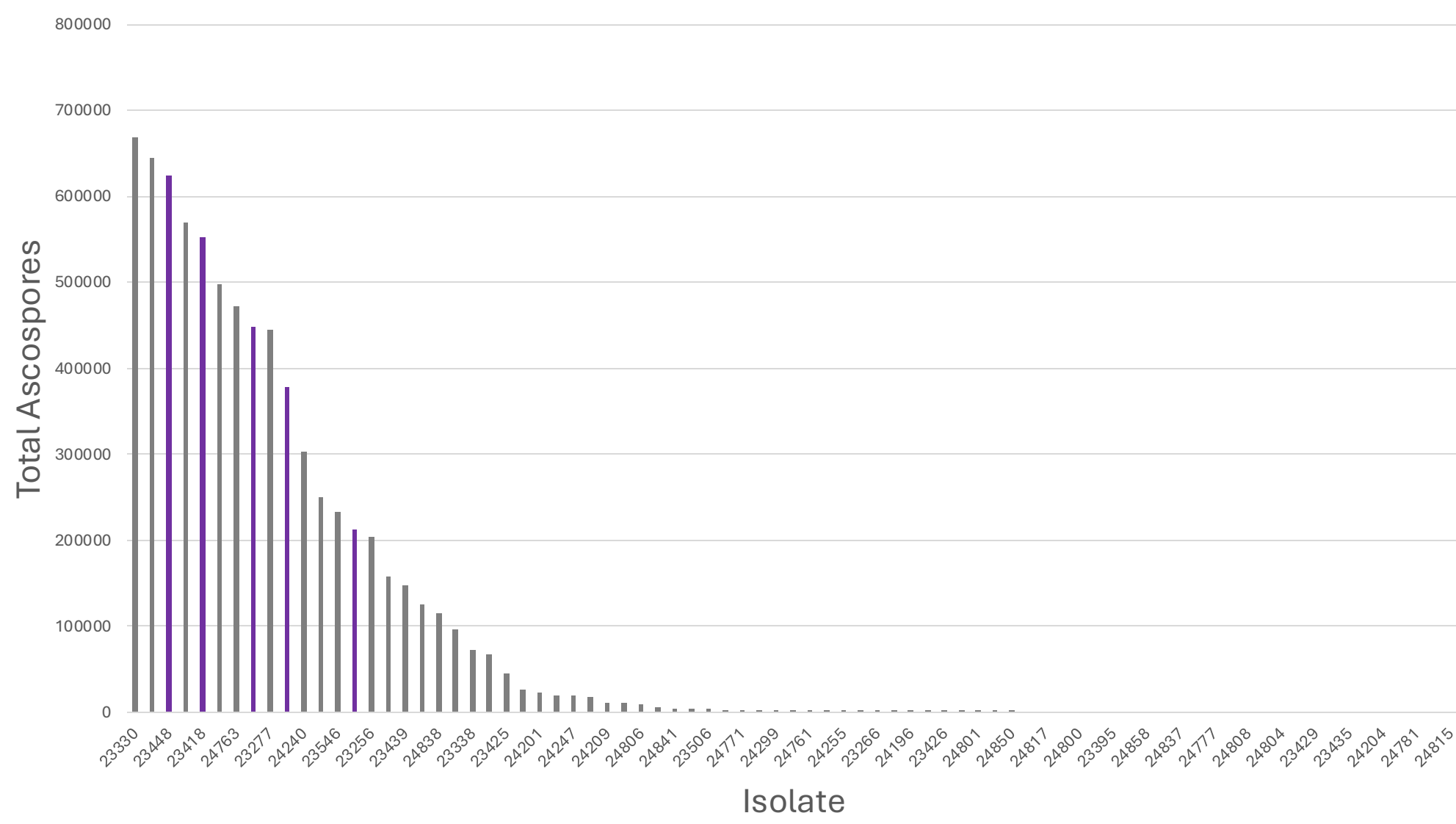
Perithecia from isolate 23256 under microscope



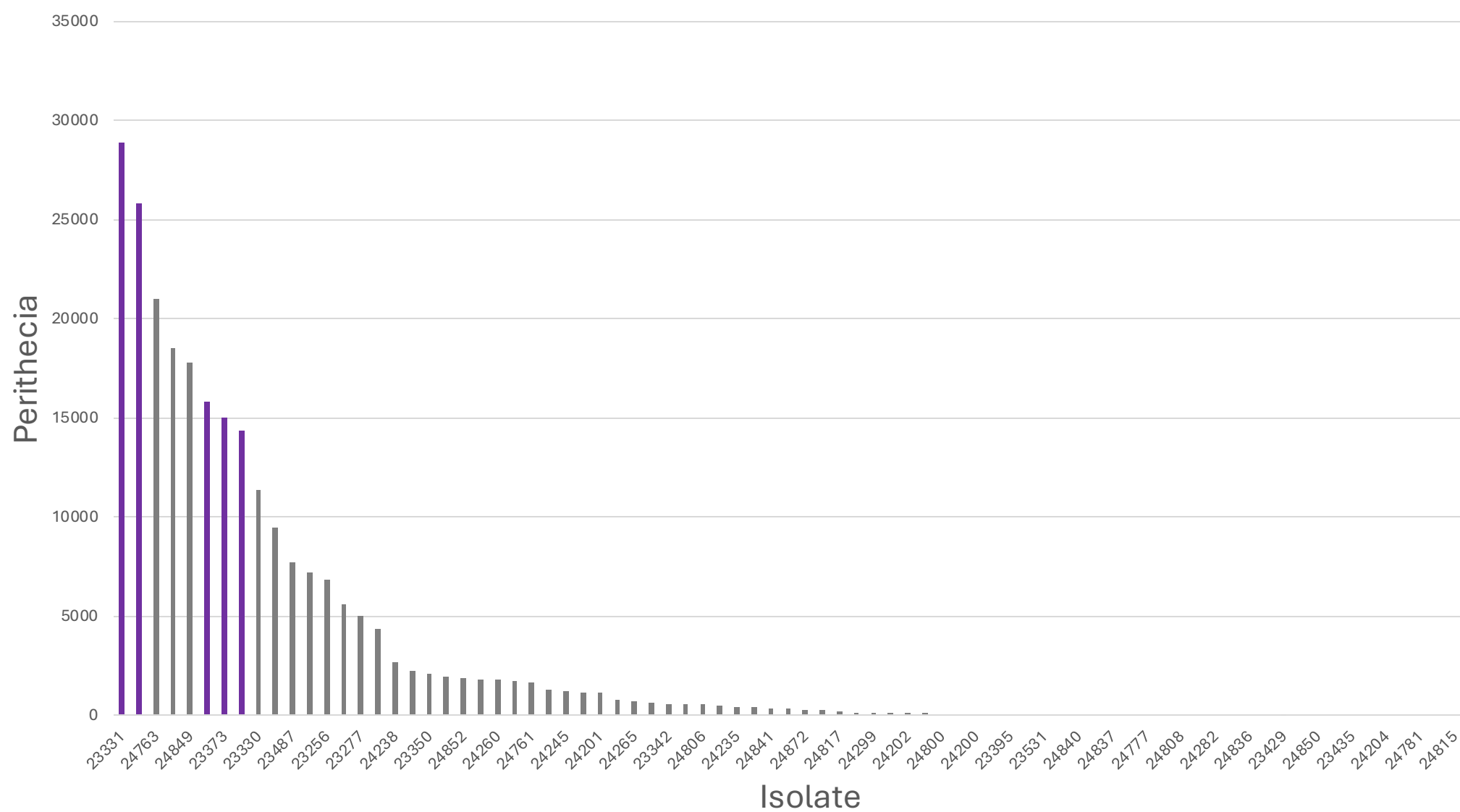
Samples with many ascospores will form brown pellet



Ascospores from isolate 24240



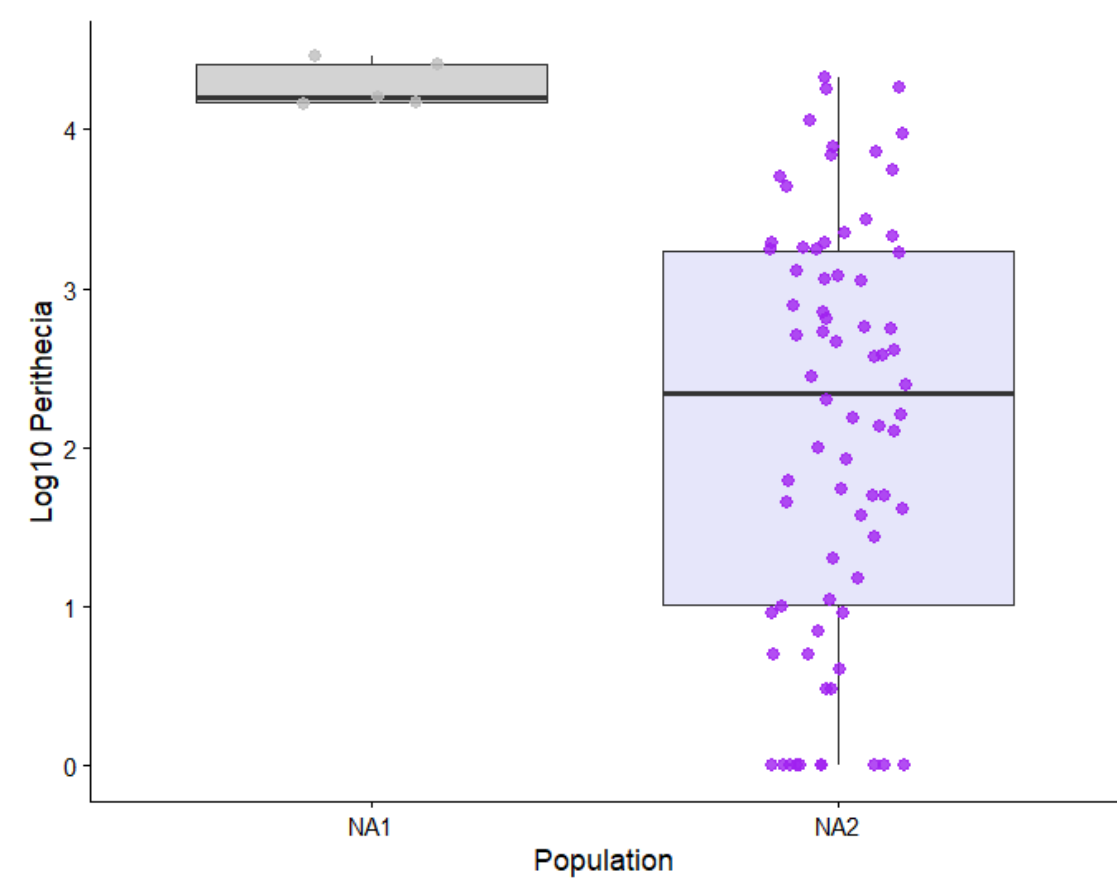
Ascospore production by isolate, NA1 population is highlighted in purple



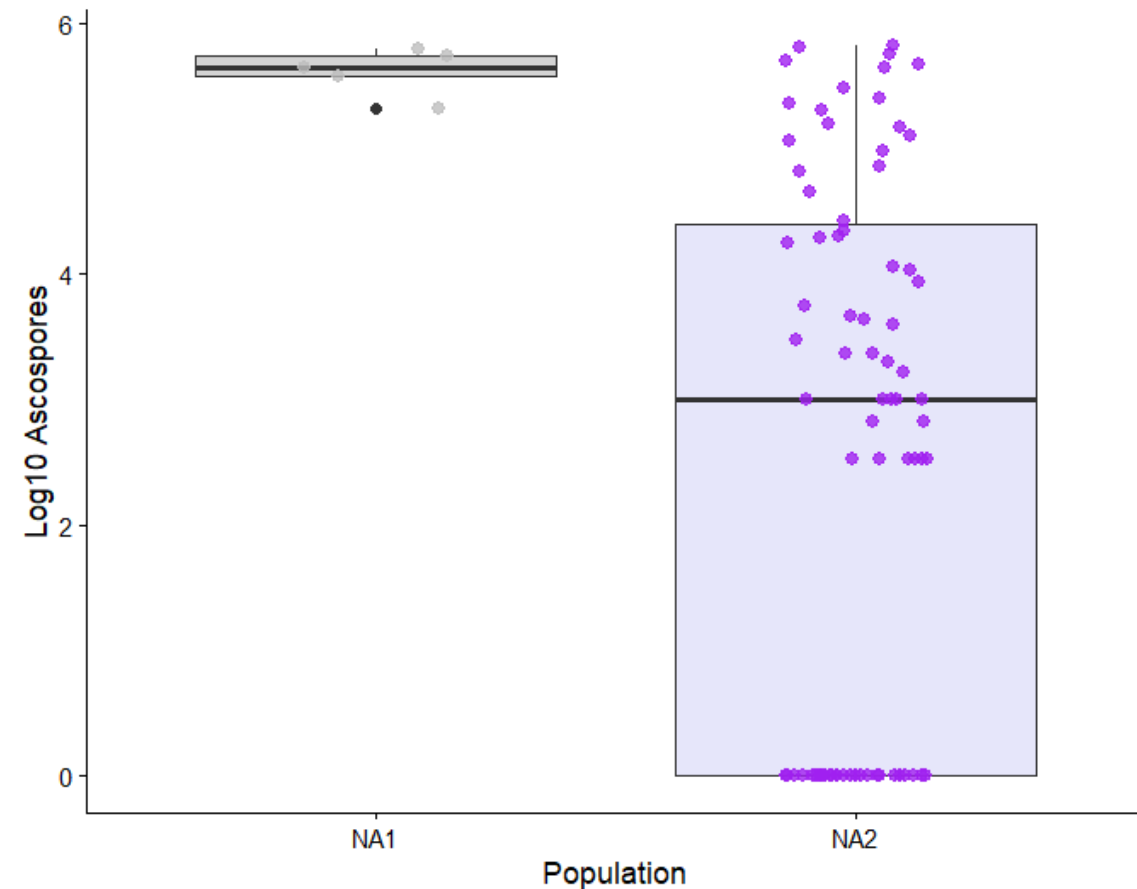
Number of perithecia produced by isolate, NA1 population is highlighted in purple

- Of the 79 isolates used for this experiment 5 were from the NA1 population, the other 74 are from the NA2 population
- All 5 of the isolates from the NA1 population were high producers for both perithecia and ascospores, while the NA2 population had a large range of values including some that did not produce either perithecia or ascospores.

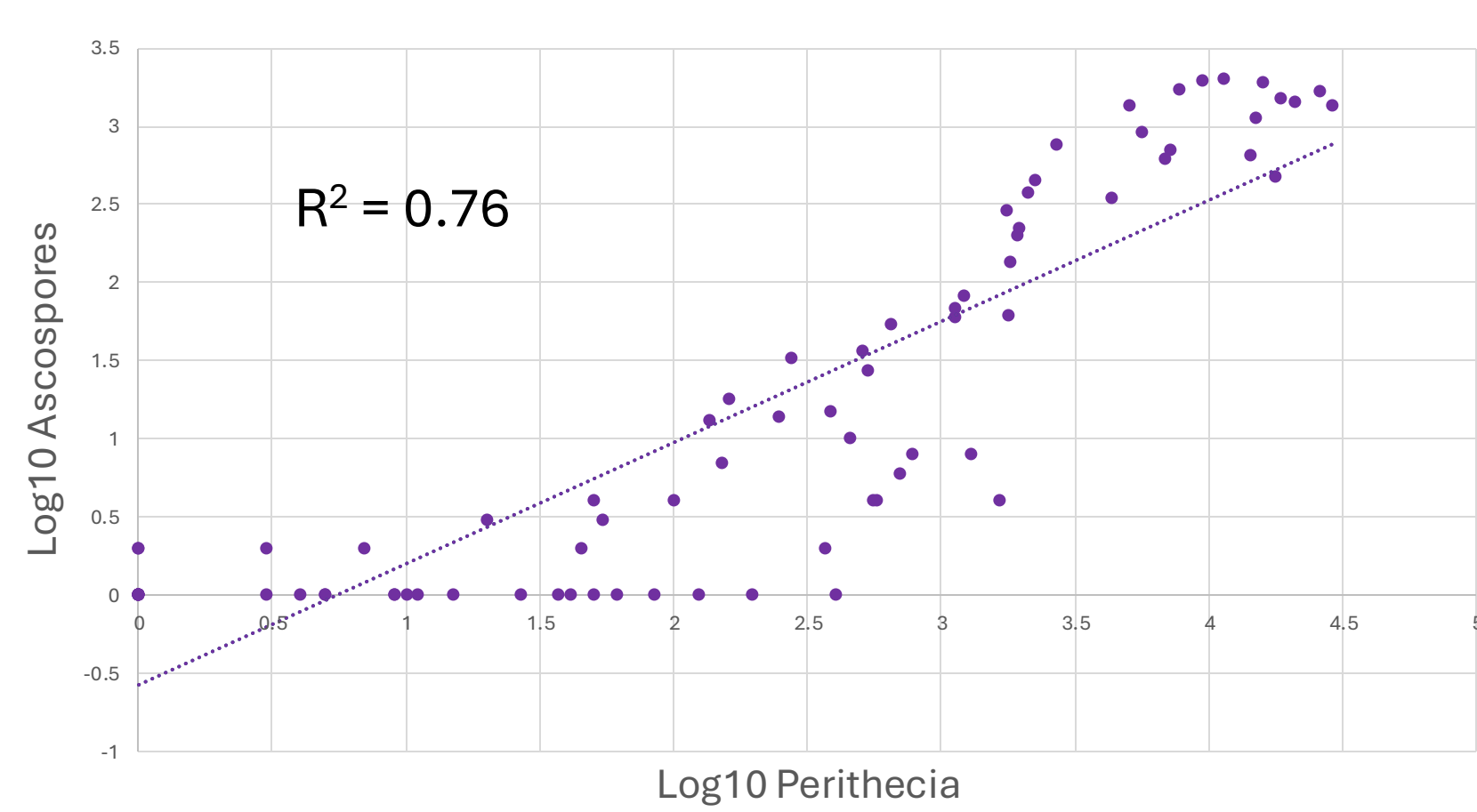
Conclusion



Boxplot showing difference in perithecia production between NA1 and NA2 populations



Boxplot showing difference in ascospore production between NA1 and NA2 populations



Graph showing correlation between number of perithecia and ascospores

- There is a high correlation between number of perithecia and number of ascospores produced
- The NA1 population appears to be higher producers of perithecia and ascospores than the NA2 population
- Since ascospores are the primary way *F. graminearum* begins a new infection, this would suggest that the NA1 population would spread more readily than the NA2 population

Future Directions

- More replications should be done to increase the accuracy of the data
- With a robust data set, variation in production of perithecia and ascospores will be compared to genome sequences of the isolates, and single nucleotide polymorphisms (SNPs) that may be related these traits will be identified

Acknowledgements

This work is supported by the NIFA Research and Extension Experiences for Undergraduates (REEU) Program grant no. 2024-68018-42431/project accession no. 1032359 from the U.S. Department of Agriculture, National Institute of Food and Agriculture.



National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE

This work is also supported by USDA NIFA grant no. 2023-67013-39158