

Beech Leaf Disease at the Huston-Brumbaugh Nature Center

Featured scientist: *Hannah Mitchell*

Collaborating scientist: *Dr. Jason Smith, University of Mount Union*

Research Background: What is causing Beach Leaf Disease?

Beech Leaf Disease (BLD) is caused by a **microscopic roundworm** (a type of nematode) called *Litylenchus crenatae mccannii*. These tiny worms are so small you can't see them without a microscope, but they can do serious damage to beech trees.

The nematodes live inside the **leaf buds** of beech trees. In the spring, when the leaves start to grow, the nematodes are already inside, feeding on the developing tissue. This causes the leaves to grow with **dark green bands**, become **leathery**, and sometimes **curl or shrink**. Over time, the tree loses its ability to make enough food through photosynthesis, and it starts to weaken.

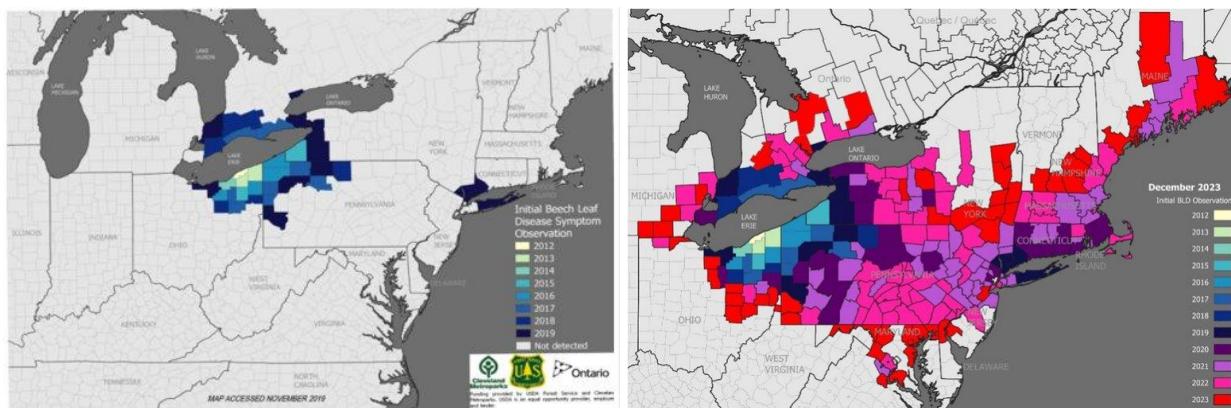


Photo credit Hannah Mitchell

As the summer goes on, the number of nematodes increases. By fall, they move into the new buds, ready to start the cycle again next year. If this happens year after year, the tree can die—**young trees in just a few years**, and older trees in about **6 to 10 years**.

Scientists are still trying to figure out exactly how the nematodes move from tree to tree.

Maps showing BLD symptoms help researchers like Hannah track where the disease is spreading and how severe it is in different areas. These visual tools are important for spotting patterns and deciding where to focus future monitoring and research.



tergardeners.com/2020/06/20/beech-leaf-disease-mystery-a-nematode-is-the-main-suspect/

Guiding Question:

1. Compare the two maps showing Beech Leaf Disease symptoms. What differences do you notice in the number or location of affected areas? What might this tell us about how the disease is spreading over time?

Hannah Mitchell, a student researcher at the University of Mount Union, wanted to understand how this nematode spreads. It's known to move through soil and water, but could it also be traveling through the air?

To test her hypothesis, Hannah used **spore traps**—devices that spin and collect particles from the air. She placed these traps near **healthy beech trees** and left them out for one week at a time.

She also placed **uninfected beech saplings** near the traps to see if they would develop symptoms over time.



A spore trap with uninfected beech saplings placed at the bottom of the traps.



Spore Trap used by Hannah to collect particles from the air.

To find out if the nematode was present, she used:

- **DNA extraction kits** to dissolve the membranes from the traps using Qiagen Dneasy plant pro kit.
- **PCR (Polymerase Chain Reaction)** to amplify nematode DNA
- **Gel electrophoresis and qPCR** to detect DNA
- **Microscopy** - membrane is peeled off the spore trap and stuck to a glass slide to visually examine the membranes

Guiding Questions:

2. What was Hannah's research question?

3. Why did Hannah use both DNA testing and microscopy?

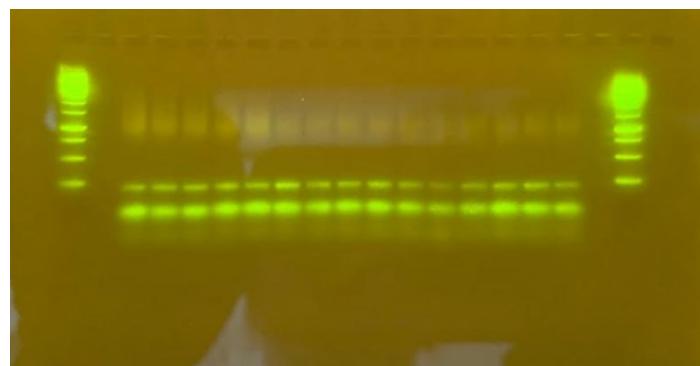
4. What does PCR help scientists do?

The Data: What did Hannah find?

To find out if the nematodes that cause Beech Leaf Disease were floating in the air, Hannah used a tool called **gel electrophoresis** after performing **PCR (Polymerase Chain Reaction)**.

Here's how it works:

1. **Collecting DNA:** First, she dissolved the membranes from the spore traps to extract any DNA that might be stuck to them.
2. **Amplifying DNA:** Then, she used PCR to make millions of copies of a specific piece of nematode DNA—just enough to detect it.
3. **Running the Gel:** She placed the DNA into a gel and ran an electric current through it. This separates the DNA by size.
4. **Reading the Results:** If the nematode DNA was present, it would show up as a glowing band in a specific spot on the gel.



When Hannah saw those glowing bands, it meant that **nematode DNA had been captured from the air**—supporting her idea that the nematodes (or at least their genetic material) were airborne.

5. Does finding nematode DNA in the air prove that the nematodes are floating on their own? Why or why not?

6. What are some possible “vectors” that could carry nematodes through the air?

7. How does Hannah's research help scientists better understand Beech Leaf Disease?

Your next steps as a scientist:

8. Science is an ongoing process. What new question(s) should be investigated to build on Hannah's research? How do your questions build on the research that has already been done?

Citation:

1. **Mitchell, H. & Smith, J. (Summer 2024).** *Beech Leaf Disease*. PPT presentation. Brumbaugh Scholar Program. University of Mount Union, Alliance, OH 44601