Focus on Forest Health:
New Forest Health Threat--Beech Leaf Disease

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In 2012, John Pogacnik, Biologist with Lake County Metroparks, noticed some sickly-looking American beech (*Fagus grandifolia*) trees and saplings at one of his parks. The next year, he noticed the same issue in six additional parks. This led him to contact the U.S. Department of Agriculture (USDA) Forest Service and Ohio Department of Natural Resources (ODNR) Division of Forestry for help in determining what could be causing this dieback.

Over the next few years, Alan Iskra (now retired Forest Pathologist with the USDA Forest Service) and I made several visits to northeastern Ohio to meet with John and others to investigate. John showed us the interesting initial symptom of thickened tissue between two or more lateral leaf veins, which stands out as dark areas relative to healthy tissue, especially noticeable when looking upwards at backlit American beech leaves. This leaf "striping" symptom eventually progresses to leaves that are entirely thickened, leathery, and dark-appearing. In subsequent seasons, symptomatic trees will produce fewer leaves and buds and branch dieback occurs, typically moving from the lower branches upwards.

These early explorations were frustrating for us as there were no obvious causal organisms or evidence present on symptomatic trees, such as insects or mites or their feeding damage, fungal fruiting bodies, or discoloration of xylem tissue under the bark. We collected samples and sent them to various plant pathologists and entomologists, but no obvious cause was identified. All the while, this issue-- dubbed "beech leaf disease" -- was appearing to spread across northeastern Ohio and symptomatic trees were identified in southwestern New York in 2015, northwestern Pennsylvania in 2016, and just across Lake Erie in Ontario, Canada in 2017. This problem was beginning to get the attention of many concerned landowners, agencies, and organizations. Some of those involved in monitoring and diagnostics in Ohio included Cleveland Metroparks, The Holden Arboretum, Ohio State University, USDA Forest Service's Northern Research Station and State & Private Forestry, and Ohio Department of Agriculture.

Today, beech leaf disease is widespread and common in several northeastern Ohio counties, and in some areas, nearly every American beech tree is affected. Beech leaf disease appears to be causing mortality of understory

Dark "striping" on American beech leaf typical of early stages of beech leaf disease. Photos by ODNR

saplings and small trees, while mortality of overstory canopy trees has not been observed on a large scale, though many mature beech trees show significant decline.

In late 2017, David McCann, Plant Pathologist with the Ohio Department of Agriculture, was examining symptomatic beech leaves under a microscope and noticed what appeared to be nematodes (microscopic worms) within the leaf tissue. He sent some samples to nematologists with the USDA Agricultural Research Service in Maryland, who confirmed the

Map showing the distribution of the presence of symptoms of beech leaf disease and the year symptoms were first observed in each county. Map by Cleveland Metroparks

nematodes were a species in the genus *Litylenchus*, and that this was the first documentation of this genus in the western hemisphere. Interestingly, just after this discovery, an article was published in Japan describing a new species of nematode, which was causing leaf symptoms on Japanese beech (*Fagus crenata*). It has since

Back-lit American beech leaves showing striping symptoms of beech leaf disease.

been confirmed that the nematode described in that article (*Litylenchus crenatae*) is the same nematode species found on beech leaves here in Ohio.

Recent investigations have revealed that symptomatic leaves are nearly always accompanied by the presence of nematodes (up to several thousand per leaf), with none occurring on leaves that lack symptoms. While these findings seem to suggest that the nematodes are playing a role in causing the leaf symptoms of beech leaf disease, confirmation requires the inoculation of a healthy beech tree with nematodes to see if symptoms develop, confirming that they do indeed cause beech leaf disease. A team of scientists from the USDA Forest Service (Northern Research Station and State & Private Forestry), USDA Agricultural Research Service, The Holden Arboretum, Ontario Ministry of Natural Resources & Forestry, and Agriculture and Agri-Food Canada set out to do just that. They are making progress in confirming a causal agent of beech leaf disease and should be publishing their findings soon.
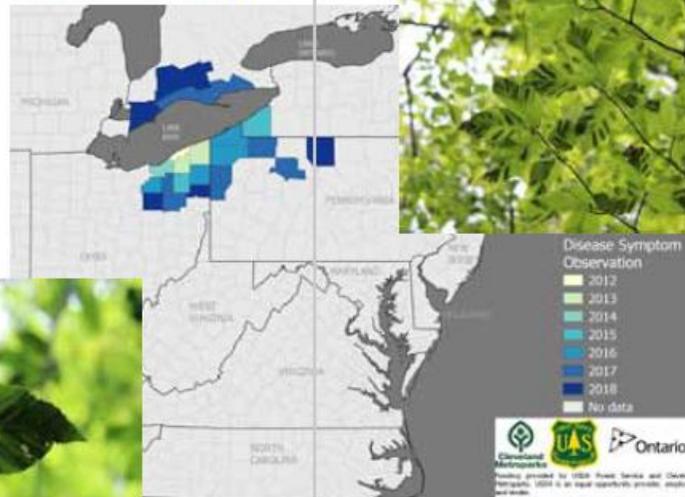
In addition to identifying the causal agent of beech leaf disease, determining the distribution and symptom development of beech leaf disease are also important areas of work. The USDA Forest Service State & Private Forestry is funding much of this work. To determine the distribution of beech leaf disease, Constance Hausman and Daniel Volk with the Cleveland Metroparks, in partnership with Kent State University, have developed a smartphone app called "Tree Health." The app includes photos of beech leaf disease symptoms and allows

users to submit reports of American beech trees that have been evaluated for symptoms.

Anyone can download the app (at this link: https://itunes.apple.com/us/app/tree-health/id1227301516?mt=8) and submit data, though it is currently only available for iPhone (an Android version should be available soon). The goal for 2019 is to get 10 reports from every county in Ohio. Even though many reports outside of northeastern Ohio will likely not include beech leaf disease symptoms, these "negative" reports are still useful data. To assess how beech leaf disease impacts individual trees, several organizations and agencies are establishing long-term monitoring plots, in which tree health metrics and beech leaf disease symptom severity will be tracked over time.

While American beech typically does not carry great timber value, it has great ecological value, due in large part to its hard mast crop of beech nuts and tendency to hollow out with age, providing food and important habitat for cavity-nesting birds and mammals. This tree species makes up a significant portion of Ohio's forest composition and increasing awareness and reporting of possible beech leaf disease symptoms will help researchers and managers respond to this issue.

As work on identifying the causal organism, distribution, and impact of beech leaf disease progresses, the next step will be developing options

More advanced beech leaf disease symptoms of discolored and disfigured American beech leaves.

to slow or stop its spread and protect trees from its damage. The ODNR Division of Forestry and other groups working on beech leaf disease will be sure to share the latest news on this important forest health issue as we learn more. ◆

Citations/further reading:

Ewing, C.J., C.E. Hausman, J. Pogacnik, J. Slot, and P. Bonello. 2019. Beech leaf disease: an emerging forest epidemic. Forest Pathology. 49(2) e12488.

Kanzaki, N., Y. Ichihara, T. Aikawa, T. Ekino, and H. Masuya. 2018. Litylenchus crenatae n. sp. (Tylenchomorpha: Anguinidae), a leaf gall nematode parasitising Fagus crenata Blume. Nematology. 21(2) 5-22.