DETECTIVE DENDRO

THE DIAGNOSTIC SLEUTH

By Wes Kocher and Amy Theobald

The Case of the Peculiar Pine Puzzle

The long, lazy days of summer had arrived. The evening sun was setting a little bit earlier; the growth of the grass in my clients' yards had come to a standstill; and I had finally caught up on jobs that had been scheduled since before the last frost in May. One thing that hadn't ebbed was the temperature in southern Wisconsin. As we rolled into town, we learned it had surged to a balmy 90°F (32° C) for the sixth day in a row.

Our planned route to the ISA Annual Conference & Trade Show in Milwaukee included a stop at a new client's house in Waukesha, which is just outside of the city. We knew we'd enjoy ourselves at the conference, but meeting in Brew City would be a special treat. Taking a few days off from detective duty to catch up on the latest arboricultural research and meet up with old friends is always great. And this year, I'd devote some extra time to some special research—visiting Milwaukee's prolific and prosperous pubs!

A woman named Jamie Juglans had called my office about a few rapidly deteriorating Austrian pines (*Pinus nigra*) in a windbreak on her property on the south side of town. Codit and I were on the case.

The first thing we saw as we pulled up to the house was the extensive collection of whirligigs, duck decoys, weathervanes, and other outsider art covering the lawn, flanking the sidewalk leading to the door, and standing sentry from every corner of the front of the house. It turned out that Jamie was a curator at the Milwaukee Art Museum—incidentally, an institution with a great collection with a stunning view of Lake Michigan—and specializes in American folk art. She obviously enjoys what she does, surrounding herself with the fruits of her research personally and professionally. A redheaded woman rose from a porch swing with a thick book in hand and walked over to greet us.

"I'm so glad you could come by," said Jamie, extending her hand to Codit and me, "the Honeydews speak so highly of your work."

"It's our pleasure, ma'am. That's quite a lot of whatchamawhoozits you've got there," Codit said, gesturing toward the house.

"The whimsical works are wondrous," I agreed.

"Yes, thanks. My collection is growing and changing all the time," she said, smiling. "Here's the group of trees I called you about. My family and I had them planted about 20 years ago. They've always been really healthy, until early July, when, one by one, they started to go downhill fast."

The art was so amusing that we hadn't yet noticed the row of Austrian pines planted along the property line. Out of the approximately thirty trees, it was apparent that six of the pines were not in good shape. Equally obvious was the fact that there was no discernable pattern to the trees that were declining: three healthy trees, one declining, one healthy, two declining, and so on.

"It looks like whatever is affecting these trees can't make up its mind about what to do," Codit mumbled. "I

CURTIS E. YOUNG

A row of Austrian pines (*Pinus nigra*) are sporting an unusual pattern of decline.

always look for physical and abiotic factors first, just like you taught me, Detective, but I can't figure out what stressors could cause this kind of pattern."

"The abnormally dry summer could certainly have increased the stress level on these trees, my young apprentice, but I'm inclined to agree with you. Environmental stress is only one chapter of this suspicious saga."

Codit scratched his chin. "I've never seen such a severe case of Diplodia blight. The whole tree is dying."

"Wait a second, Codit, Diplodia isn't a foregone conclusion here since it usually starts by affecting only the needle tips. Let's get a sample of an affected branch to look for pin-head sized, black fruiting bodies embedded in the brown needles. That will go further to confirming your suspicion."

As the three of us walked toward the trees, some key indicators of the culprit started accumulating. The six affected pines were declining from the top down, but unlike specimens with many needle diseases, the needles remained attached to their twigs.

Codit snipped a twig in the upper canopy with a pole pruner so we could get a closer look. "Nope, no fruiting bodies. And the needles don't appear to be declining from the tips but are completely discolored. What's up with that? I'm used to seeing these grayish-green colored needles on spruce (*Picea*) trees, but not on Austrian pines."

"Although I can't be 100% sure without lab analysis, Codit, I've got a strong hunch that our culprit here is one that arborists in Japan might be all too familiar with."

What has the detective deduced?
Turn to page 63 to find out.

WHAT'S THE SOLUTION?

The fact that not all of the trees were affected and that the trees initiated symptoms of decline at different times helped rule out physical factors or herbicide damage. The cause of these trees' degeneration required the responsible pathogen be transported from tree to tree by an unsuspecting host, the pine sawyer beetle (*Monochamus* spp.). In combining Jamie's location in the upper Midwest with every symptom we observed and the species of the affected trees, it all led me to one primary suspicion: pine wilt disease.

The nematode that causes pine wilt disease is called the pine wood nematode (*Bursaphelenchus xylophilus*) and is only about 1 mm in length. It is transported from tree to tree by the pine sawyer beetle. When the beetle feeds on the tree, the nematode emerges from the beetle's respiratory system and enters the tree through the feeding wounds.

Once in the tree, the nematode—which looks like a microscopic worm, unsegmented—travels through the tree via xylem resin canals, from the trunk to the branches and into the roots. The nematode travels throughout the tree and feeds on cells surrounding water conducting tissues, disrupting the trees' water supply, causing rapid death (usually within a few short weeks or months, and especially with the onset of hot weather). Because of the quick death, the trees retain their dead brown needles, making trees killed by the disease strikingly obvious when observed next to healthy pines.

As I explained the likely cause to Jamie and Codit, a mournful look came across Jamie's face. "Is there anything that we can do to save my pine trees?" she asked.

"I'm afraid not for the ones that are already infected. Once trees are showing symptoms like these, there is no cure. The beetles and nematodes can emerge at various times throughout the summer, making pesticides cost-prohibitive and ineffective. The only thing to do is try to limit the spread of the disease to healthy trees. We'll need to remove and destroy these six, ideally before the beetles emerge from the wood." I paused and reflected on the weather. "I know it's tempting, given the chilly winters that you experience here, but it isn't safe to hold the wood for firewood. Hopefully, with some quick action, we'll limit the impact on the rest of the group."

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Close-up photo of pine wilt roughly one-year following death of tree.

Susceptible Species

Trees most susceptible to pine wilt disease are Austrian pine, Scots pine (*Pinus sylvestris*), jack pine (*Pinus banksiana*), mugo pine (*Pinus mugo*), red pine (*Pinus resinosa*), and to a much lesser extent, white pine (*Pinus strobus*). The disease is extremely common and has caused serious economic damage in Japan, where it was first discovered, and is now known to have been introduced. Although only later discovered in the United States (in 1979), the nematode is native to the U.S, which explains the relative resistance of native pine species. The disease is currently found affecting trees in the Midwestern U.S. and Europe's Iberian Peninsula.

The only way to completely confirm a field diagnosis is to send an affected sample branch, one to three inches (3–7 cm) in diameter and 8 to 12 inches (20–30 cm) in length, to a diagnostics lab where the nematode can be extracted and identified.

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The nematode that causes pine wilt disease is called the pine wood nematode (*Bursaphelenchus xylophilus*) and is only about 1 mm in length. The pine sawyer beetle (*Monochamus carolinensis*), pictured here, is known to transmit the nematode from tree to tree.

I could tell Jamie was sad but felt confident in our evaluation and diagnosis. "Okay then, can you give me an estimate and get started on the removals soon?"

While Codit went back to the truck to fetch what we needed, I sat down on Jamie's front steps and took out my smartphone. ISA has a great app for the conference this year, where I had been watching the countdown 'til the event, accessing details on the educational sessions and presenter biographies, and customizing my own schedule for attending the sessions throughout the conference. I remembered there was a feature that was going to come in handy at the end of the work day: the Info Booth. That particular section of the app had a Visit Milwaukee link, listing a lot of things to explore in Brew City, including suggestions for dining and nightlife. When Codit returned, he looked over my shoulder, smiled, and said, "What's on tap for tonight, Boss?"

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