

How oak death spores survive baffles scientists

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The tree-strangling pathogen that causes sudden oak death is baffling scientists even after 14 years on its trail.

The latest puzzle for sleuths in the field and laboratory is how the microscopic misfit manages to survive in waterways after all known sources and hosts have been removed.

Ten creeks, streams, drainage ditches and holding ponds in six states have been contaminated by the disease causing organism, known scientifically as *Phytophthora ramorum*, mostly as a result of irrigation runoff from nurseries, according to scientific papers released at a recent symposium.

The mysterious pathogen has also been found in Crystal Springs Reservoir in San Mateo County and nearby drainages in the vicinity of infected and dying oak trees.

In several cases, the pathogen has persisted in the water, according to scientists, despite the fact that all runoff was halted, infected material was removed and the surrounding area was fumigated.

The most troubling case is in Humboldt County, where two streams tested positive for spores tracked to a nearby nursery. The creek is at least a mile away from the nursery and there is no hydrological connection between them and no way for runoff to reach the stream.

"It is a completely baffling thing and it is very frustrating," said Yana Valachovic, a forester with the University of California Cooperative Extension Program out of Eureka.

Difficult to stop it

The findings raise serious questions about how one can stop a microbial disease that gets more mysterious the more scientists learn about it. Millions of dollars in state and federal money have been spent trying to understand the disease and stop its spread, but the spores keep

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spreading and trees keep toppling.

Sudden oak death, first discovered in Mill Valley in 1995, has killed tens of thousands of oak trees from Big Sur to southern Oregon. The pathogen infected hundreds of nurseries around the country in 2004 after diseased ornamental plants were shipped from Monrovia Growers in Azusa (Los Angeles County).

Spreads through water

Arborists and ecologists are afraid that sudden oak death could eventually denude California's golden hills of its signature tree.

It has been known for some time that *Phytophthora ramorum* spreads in water. After the 2004 Monrovia debacle, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service ordered testing of water and waterways near infected nurseries.

Since then the pathogen has been detected in waterways near nurseries in Florida, Georgia, Alabama, Mississippi, Washington, North and South Carolina. But it was the case in Humboldt County that stood out.

Scientists were baffled in February when ramorum spores were discovered in Mill Creek in McKinleyville, 13 miles north of Eureka and 45 miles north of the nearest infested forest. Mill Creek is 2 miles south of Widow White Creek, where inoculum from the pathogen was detected in 2006 and 2007. Neither stream has any vegetation around it that is known to carry the pathogen.

Transfer a mystery

Infected plants were found in a nursery between the two creeks in 2004, 2006 and 2007, but scientists cannot figure out how the spores got into the streams. Mill Creek is on a coastal bluff north of the Humboldt Bay watershed at least a mile away from the nursery.

"There is some connection that I don't understand," Valachovic said. "The genetics match with the nursery, so it appears that it originated in that nursery. How it got to the stream is undetermined."

Researchers with the Forest Pathology and Mycology Laboratory at UC Berkeley are trying to find answers at the Crystal Springs Reservoir.

Catherine Eyre, a post-doctoral researcher with the lab, said sporangia from the disease have been found in the water in at least half of the 14 sites tested this year in and around the reservoir, which supplies drinking water to millions of people in San Francisco and the Peninsula.

"We're looking at how far the pathogen can travel and how long it can survive," said Eyre, adding that the spores are not dangerous to humans. "This is important because it could be one of the ways it is spreading around the state."

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