CALIFORNIA OAK MORTALITY TASK FORCE REPORT
APRIL 2023

Editors' note: This month we report recent detections of *Phytophthora ramorum* in Del Norte County. Will this be a harbinger of things to come? The shift to wetter weather in California provides more conducive conditions for *P. ramorum* infection and spread. Also included this month are excerpts from essays or poems that describe some of the emotions brought on by sudden oak death. People's love of trees and concern for the environment are reflected in their reactions to the loss of trees to disease.

CALIFORNIA WILDLANDS

Recent detections confirm the presence of both EU1 and NA1 lineages of *P. ramorum* in Del Norte County. In 2019, the NA1 lineage was detected on two trees in Jedediah Smith State Park, both by isolating the pathogen in culture and by molecular analysis (PCR) of plant tissue, as part of the SOD Blitz program run by the UC Berkeley Plant Pathology and Mycology Lab in cooperation with UC Cooperative Extension Humboldt-Del Norte and CAL FIRE. The infected trees were on opposite sides of Mill Creek, a large tributary to the main stem Smith River. Subsequent intensive sampling in 2020, 2021, and 2022 in the same area failed to recover the pathogen a second time, although *Armillaria* sp., *P. nemorosa,* and *Diplodia corticola* were all detected on one of the infected trees, which subsequently died. Meanwhile, the EU1 lineage of the pathogen was detected in 2020 approximately six miles away near another Smith River tributary, downstream from the original NA1 detection. Management and monitoring of the EU1 infestation have been ongoing, with limited spread observed since the initial detection.

In February of this year, dead and dying tanoaks were observed along Mill Creek, near the original NA1 detection, and *P. ramorum* grew from the collected tanoak samples. The samples were confirmed by the California Department of Food and Agriculture (CDFA) Plant Pathology Laboratory and sent to the USDA Agriculture Research Service (ARS) lab in Corvallis, OR for genotyping and further analysis, where their identity as NA1 was confirmed. Samples were also sent to UC Berkeley for further analysis. Delineation of the new infestation to determine its extent is ongoing but difficult because the pathogen appears to be established on both banks of Mill Creek. For more information contact Chris Lee, christopher.lee@fire.ca.gov, or Wallis Robinson, wlrobinson@ucanr.edu.

NURSERIES AND MANAGED LANDSCAPES

California Department of Food and Agriculture (CDFA) *P. ramorum* nursery program update: Spring compliance inspections underway and a newly positive interstate shipping nursery. Regulated nurseries in counties quarantined for *P. ramorum* and five California nurseries that were previously positive for *P. ramorum* are being inspected and sampled this spring in compliance with 7 CFR 301.92. One interstate shipping nursery not positive previously was found positive for *P. ramorum* in February 2023. Also, in February, *P. ramorum* was detected at an interstate shipping nursery that has been previously positive for *P. ramorum*. Both positive nurseries are undergoing or have completed USDA's Confirmed Nursery Protocol for Interstate Nurseries Containing *Phytophthora ramorum*. Trace investigations searching for potentially positive plants shipped from the two positive nurseries are underway in 30 counties. The positive plants detected at the two positive nurseries are *Peiris* sp., *Camellia* sp., and

Osmanthus burkwoodii. For more information contact Carolyn Lambert, Carolyn.Lambert@cdfa.ca.gov.

Washington State Department of Agriculture (WSDA) *P. ramorum* program update. In March, WSDA received trace-forward information on plants that shipped to two homeowners from a positive out-of-state nursery. Inspectors will follow up at each location once the plants have broken dormancy and leaf material is present to inspect.

Also in March, Washington's only regulated interstate shipping nursery was released from the *P. ramorum* program. The nursery tested negative for six consecutive compliance surveys. For more information contact Scott Brooks, SBrooks@agr.wa.gov.

RESEARCH

Capron, A.; Herath, P.; Alayon, D.; Cervantes, S.; Day, B.; Brar, A.; Bilodeau, G.; Shamoun, S.; Webber, J.; Brasier, C.; Feau, N. and Hamelin, R. 2023. SODplex, a series of hierarchical multiplexed real-time PCR assays for the detection and lineage identification of *Phytophthora ramorum*, the causal agent of sudden oak death and sudden larch death. PhytoFrontiers, https://doi.org/10.1094/PHYTOFR-09-22-0095-FI.

Since its emergence in the 1990s, the invasive pathogen *Phytophthora ramorum* has spread in Europe and the West Coast of North America, causing sudden oak death in the United States and sudden larch death in the UK, resulting in the mortality or destruction of millions of trees. Due to its invasive nature, its damage potential, its wide host range and its ability to disseminate via the plant trade, *P. ramorum* has been placed on quarantine lists worldwide. Rapid and reliable detection of the pathogen and identification of its lineages are crucial to limit spread and inform mitigation and eradication efforts. SODplex, a suite of new multiplex real-time PCR tools, was developed to streamline the detection and identification of *P. ramorum*. It offers four multiplexed assays covering different use-cases. SODplex-base combines primers and probes for the sensitive and accurate detection of *Phytophthora* spp. and *P. ramorum*. SODplex-ITS and SODplex-mito, offer a single step identification of *P. ramorum* and the EU1, NA1 and NA2 lineages present in the US and Canada. SODplex-lin targets each of the four *P. ramorum* lineages present in Europe and North America in a single reaction. The assays have high levels of accuracy and are robust to use on different instruments, by different operators and at different temperatures. The redundancy comprised within the assays reduces the likelihood of false negatives and false positives. The SODplex assays presented here improve the toolbox available for the detection of *P. ramorum* and its lineages.

DIAGNOSTICS

AmplifyRP® XRT has been released by Agdia as a fast lab or field assay for *P. ramorum* identification. AmplifyRP® XRT is a real-time isothermal nucleic acid amplification and detection system that amplifies small pieces of DNA or RNA. The test can be performed on leaf tissue and run outside of a lab using a battery operated AmpliFire® fluorometer. Total assay time is less than 30 minutes but requires the AmpliFire® isothermal fluorometer. The test is specific for *P. ramorum,* detects all European and North American lineages, and is not known to cross react with other *Phytophthora* species, *Phytopythium,* or *Pythium.* The assay was developed utilizing technology developed by Frank Martin, USDA Agriculture Research Service and Tim

Miles, now at Michigan State University. More information is available from the Agdia, Inc. website, www.agdia.com or e-mail info@agdia.com.

RELATED RESEARCH

Halpern, A.A.; Sousa, W.P.; Lake, F.K.; Carlson, T.J. and Paddock, W. 2022. Prescribed fire reduces insect infestation in Karuk and Yurok acorn resource systems. Forest Ecology and Management. 505: 119768. https://doi.org/10.1016/j.foreco.2021.119768.

Hulbert, J.M.; Hallett, R.A.; Roy, H.E.; Cleary, M. 2023. Citizen science can enhance strategies to detect and manage invasive forest pests and pathogens. Frontiers in Ecology and Evolution. 11: 1113978. https://doi.org/10.3389/fevo.2023.1113978.

Kasteel, M.; Ketelaar, T. and Govers, F. 2023. February. Fatal attraction: How *Phytophthora* zoospores find their host. Seminars in Cell & Developmental Biology. Academic Press. https://doi.org/10.1016/j.semcdb.2023.01.014.

Kronmiller, B.A.; Feau, N.; Shen, D.; Tabima, J.F.; Ali, S.S., Armitage, A.D., ... & Grünwald, N. J. 2023. Comparative genomic analysis of 31 *Phytophthora* genomes reveals genome plasticity and horizontal gene transfer. Molecular Plant-Microbe Interactions. 36(1): 26-46.

Mullett, M.S.; Van Poucke, K.; Haegeman, A.; Focquet, F.; Cauldron, N.C.; Knaus, B.J.; Horta Jung, M.; Kageyama, K.; Hieno, A.; Masuja, H. and Uematsu, S. 2023. Phylogeography and population structure of the global, wide host-range hybrid pathogen *Phytophthora× cambivora*. IMA fungus. 14(1): Article number: 4. https://doi.org/10.1186/s43008-023-00109-6.

LITERARY INTERPRETATIONS OF SUDDEN OAK DEATH

Sudden oak death has been written about scientifically but also metaphorically appearing in poems, fiction, children's literature, and other art forms. The aspects of sudden oak death that are shared in fiction include the emotional and social reactions to the disease. Follow this link**,** and see brief excerpts below, to view a few interpretations of how sudden oak death has been expressed symbolically.

Sudden Oak Death by Allison Field Bell

"One spring, the tree—their oak tree—developed a strange rash. This is what the children announced. A rash, a rash. The mother and father examined the tree. Cankers, the father decided. Sores, the mother announced. The tree was oozing from the wounds on its bark…."

Excerpt from "Sudden Oak Death" by Allison Field Bell . 2022. Featured in Epiphany, A literary journal. Feb 2, 2022. https://epiphanyzine.com/features/sudden-oak-death-by-allison-field-bell.

Offerings by Deborah Miranda

"At dawn the songs begin again as if never sung before,

as if the jet stream has not wandered from its path,

the Arctic ice shelf does not melt at accelerated rates,
Sudden Oak Death does not leapfrog across the continent…”