

Sudden Oak Death Caused by a New Species, *Phytophthora ramorum*

Tens of thousands of tanoaks (*Lithocarpus densiflorus*), coast live oaks (*Quercus agrifolia*), and California black oaks (*Quercus kelloggii*) have been killed by the newly identified plant pathogen *Phytophthora ramorum*, which causes Sudden Oak Death and other diseases. Sudden Oak Death was first reported in central coastal California in 1995, when unusually large numbers of oaks and tanoaks began to die. Approximately 40 genera, including trees, shrubs, herbaceous plants, and ferns, have been found to be susceptible to *P. ramorum*. Rhododendron, camellia, and numerous other popular landscape plants are known to be affected. On many tree and shrub species, such as Douglas-fir (*Pseudotsuga menziesii*) and coast redwood (*Sequoia sempervirens*), the pathogen causes only leaf spots and twig dieback. While rarely killed by the pathogen, these host plants can serve as important reservoirs of pathogen inoculum.

The disease is widespread in coastal California where it is commonly found in two forest types: in coast redwood forests on tanoak in the understory; and in coastal evergreen forests with oaks (*Quercus* spp.), madrone (*Arbutus menziesii*), California bay laurel (*Umbellularia californica*), and other species. In California, *P. ramorum* has been confirmed in scattered locations along the Pacific coast north of San Luis Obispo County. The pathogen has also been found on dying tanoak in coastal southern Oregon, just north of the California border, where it is being eradicated. Marin, Sonoma, Santa Cruz, and Monterey counties are heavily infested, and dead and dying trees are common in the wildland-urban interface in yards, parks, and open-space greenbelts.

Symptoms and Impact: On oaks and tanoak, cankers are formed on the stems. Cankered trees may survive



Tanoak mortality caused by *Phytophthora ramorum* on the Los Padres National Forest (Monterey County, CA).

for one to several years, but once crown dieback begins, leaves often turn from green to brown within a few weeks. Some infected coast live oaks gradually lose their leaves over several years and die more slowly. Black or reddish ooze often bleeds from the cankers, staining the bark, as well as killing the mosses that grow on it. Bleeding ooze may be difficult to see if it has dried or has been washed off by rain.

Necrotic bark tissue surrounded by black zone lines is present under affected bark. Because these symptoms can also be caused by other *Phytophthora* species, laboratory tests must be done to confirm pathogen identity. If bleeding oaks and leaf spots on California bay laurel or other symptomatic hosts are adjacent to one another, the presence of *P. ramorum* is likely.



Bleeding ooze from a canker on an oak.



Removal of the outer bark of an infected oak tree reveals necrotic areas caused by *P. ramorum* surrounded by black zone lines in the bark.



Leaf spots on California bay laurel. Note they occur where water accumulates on the leaves.



Coast live oak killed by *P. ramorum* (Santa Cruz County, CA).

On small tanoaks (less than 4 inches in diameter at breast height) the first symptom may be wilting of branch tips. On larger tanoaks, infected branches die back and resprout with multiple shoots. Eventually, the entire tree dies and resprouts from the base, but the new shoots die back as well.

The pathogen has been linked to tree mortality primarily for oaks in the red oak group (*Lobatae*) and the related tanoak. The fungal pathogen causes leaf spots and twig dieback in California bay laurel and popular landscape plants, including rhododendron and camellia. Spore levels may build up rapidly on these hosts, creating a reservoir of inoculum.

A common saprophytic fungus (*Hypoxylon thouarsianum*), ambrosia beetles (*Monarthrum* spp.), bark beetles (*Pseudopityophthorus* spp.), and other organisms often colonize infected trees.

Other Oak Disorders with Similar Symptoms: Sudden Oak Death can be confused with many disorders of oaks. Several other *Phytophthora* species produce identical symptoms. Oaks defoliated by insects may appear dead, but leaves usually reflush later in the season. Canker rots, slime flux, leaf scorch, root diseases, freeze damage, herbicide injury, and other ailments may be confused with this disease.

To report infected trees or to receive additional information, please contact your State or Federal forest health specialist. On the Internet, visit the Sudden Oak Death home page at: www.suddenoakdeath.org.



Leaf spots caused by *P. ramorum* on rhododendron. Leaf spot margins caused by this *Phytophthora* are often fuzzy, rather than sharply defined.



Section of infected oak tree showing *Hypoxylon thouarsianum* fruiting bodies, a common secondary organism. Bark beetles and other decay fungi also rapidly colonize infected trees.

Photo Sources:

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