



UI Extension Forestry Information Series II

Insects & Diseases No. 11

Sudden Oak Death

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Sudden oak death syndrome (SOD) was first reported in the Netherlands and Germany in 1993, causing leaf-blight, stem cankers, and tip dieback on nursery grown rhododen-

drons and viburnums. SOD has become the latest serious threat to plant materials across the United States and was first spotted in the U.S. in 1995 on tanoak in a Marin County, CA forest. It took University of California researchers until 2001 to positively identify the pathogen, after which the USDA imposed a federal quarantine of 12 California counties.

During the summer of 2001, SOD was also found killing wild rhododendrons in Brookings, OR. Infected plants were eradicated soon after sites were found and this infestation remains confined within a 9-mile quarantined area of forested land near Brookings. The initial source of infection of these sites remains unknown.

In the spring of 2003, SOD was found in a wholesale nursery in Portland, OR and also in a retail outlet in Washington that received plants from the Oregon wholesaler. Genera affected were *Pieris*, *Viburnum*, and *Rhododendron*. Infected stock and other nearby host plants were destroyed. This outbreak is suspected to have come

from an international shipment of rhododendrons.

On March 25, 2004, SOD was confirmed on plants at Monrovia Growers in Azusa, CA and Specialty Plants, Inc. in San Marcos, CA. On March 29, 2004, the US Department of Agriculture put all 1,500 nurseries in California under a 60-day quarantine. Each nursery has been inspected for symptoms of SOD and released if no symptoms were found.

To date, there are confirmed trace forwards on stock from Monrovia in 14 states: California, Alabama, Florida, Washington, Oregon, Texas, Colorado, Georgia, Louisiana, Maryland, North Carolina, New Mexico, Tennessee, and Virginia (Situation Report #43, May 25, 2004).

Cause and Hosts

SOD is caused by the fungus-like organism *Phytophthora ramorum* (*P. ramorum*), and causes different symptoms on different hosts. Called sudden oak death when it occurs on susceptible tree species, *P. ramorum* is characterized by bleeding cankers that girdle the trunks. On affected shrub species, the disease is called *Ramorum* leaf and shoot blight and is characterized by leaf blights and shoot diebacks. Unfortunately, on many plant species symptoms of *P. ramorum* may be indistinguishable from other common *Phytophthora* fungal diseases.

Phytophthora ramorum is well adapted to cool, wet conditions and tolerates heat and drought. Unlike other species in this large fungal family that usually infect roots, *P. ramorum* is mainly a foliar pathogen. It produces several types of spores, which helps the organism survive and spread. Spores landing on wet leaves or stems germinate and infect young plant tissues. Several of the spore types can be moved with windborne rain, in irrigation water, or with water splashed onto foliage by sprinkler irrigation. *P. ramorum* is also thought to move in soil and on infected plant material. As of this writing there are 60 hosts and associated host species in at least 12 plant families (see Table 1 above and Table 2 on page 4 and 5).

Symptoms

On trees. *P. ramorum* can affect just the bark, as on beech, or both the bark and the leaves, as on tanoak. It is also possible that some trees like ash, which has highly susceptible leaves experimentally (but has not yet been found to be a natural host) may just be leaf hosts to the pathogen.



Bark infections occur as large cankers on the lower trunk that are brown to black discolored areas on the outer bark and “bleed” dark red sap. Mottled areas of dead and discolored inner bark with black lines around the edges are visible when the bark is

removed. A rapid change in the color and condition of the foliage, followed by sudden death of the tree, occur when cankers girdle the trunks of affected trees. Cankers can cause sudden death, as in California tanoak, or a slow decline over several years, as in American oak species. Cankers do not extend below the soil line and do not appear to infect the roots.



On leaves. Leaf infections appear as brown to black dead areas, often at the tip or base of a leaf. Shoots can also be affected and appear brown to black in color and may wilt.

Symptoms on specific species include:

- On conifers in the U.S.: needle blight and dieback of young shoots of Douglas fir, coastal redwood, and grand fir.
- On yew: needle blight of young foliage resulting in aerial dieback.
- On Rhododendron, Pieris, Vaccinium, and Hamamelis spp. (witchhazel): affected shoots or twigs develop a brown to black discoloration that spreads along the twig and can spread into the leaf via the petiole; characteristic symptoms are a blackening of the petiole, leaf base, and leaf tip that may extend along the mid-vein; twig cankers lead to wilting of affected shoots; development of symptoms can be rapid.
- On viburnum: infection commonly occurs at the base of the stem, causing wilting and then death. May also cause brown to black leaf infections and can also affect flowers, especially on evergreen species.
- On Camellia, Kalmia, Syringa (lilac) and Leucothoe spp.: usually confined to leaf infections; leaf lesions are brown to black and typically occur at the tip or edges of the leaf; some shoots may become infected, leading to dieback.

Management

Management efforts have been focused on eradicating the pathogen where it is found and preventing new infections. Early detection is vital to preventing the disease from spreading.

In order to limit the spread of this disease, homeowners with a suspected plant infected with *P. ramorum* should contact your nearest Extension Office and ask them about collecting a sample of the plant.

Growers may submit a sample directly. PLEASE FOLLOW THE PROTOCOL LISTED BELOW.

1. Suspect plant material must be placed in double ziplock bags and stored in a refrigerator awaiting shipment to a diagnostic facility. The preferred method for

shipment is triple packaging: two ziplock bags and an outer container. The outer shipping container should be an approved cardboard shipping box. The seams of the box should be closed with approved shipping tape.

2. Include the following information with the sample:

- Host.
- Collector's name, and date.
- Number of hosts at that site.
- Facility/location name and address, contact person, and county.
- Other potential hosts at the site and any observations.

3. Samples should be shipped via overnight delivery or hand delivered to:

S. Krishna Mohan
Professor of Plant Pathology
University of Idaho
29603 U of I Lane
Parma, ID 83660
Phone: (208) 722-6701 Ext. 218
Fax: (208) 722-6708

4. All tools and other equipment must be sanitized and/or sterilized before re-use.

Control

Phytophthora ramorum has only recently been described and knowledge of how the disease develops and spreads is limited. Currently, fungicides are being used as preventative treatments on known host plants. Most of the fungicides used to control other *Phytophthora* species do not control this organism; they can only prevent it from becoming established.

For more information on *Phytophthora ramorum* go to the USDA APHIS website at:

www.aphis.usda.gov/ppq/ispm/sod/

Parts of this article were excerpted from:

Feiber, D. 2004. Sudden Oak Death Detected on Plants Imported into Florida. News Release, Florida Department of Agriculture and Consumer Services, Tallahassee, FL.

Parke, J. J. Pscheidt, and R. Linderman. 2003. *Phytophthora ramorum*: a guide for Oregon nurseries. EM 8840, Oregon State University, Extension Service. 8 pp.

Unknown. 2001. *Phytophthora ramorum* (Sudden Oak Death). Pest Fact Sheet, Plant Health Risk Assessment Unit, Science Division, Canadian Food Inspection Agency, Pacific Forestry Centre, Canadian Forest Service, Natural Resources, Canada.

Unknown. 2004. *Phytophthora ramorum*: a threat to our trees, woodland and heartland. DEFRA, Edinburgh, UK. www.defra.gov.uk/planth/ph.htm

Unknown. 2004. USDA Announces Oak Disease Detection Program for California Nurseries. News Release, USDA APHIS Program Update, March 29, 2004.

Unknown. 2004. New Restrictions for *P. ramorum*. News Release, USDA APHIS Program Update, April 9, 2004.

This article first appeared in Woodland NOTES, Vol. 15, No. 2, Spring/Summer, 2004.

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Table 1. Plant species currently regulated for *Phytophthora ramorum (in whole or part) – June 1, 2004 – see www.aphis.usda.gov/ppq/isp/sod**

Scientific Name	Common Name
<i>Acer macrophyllum</i>	bigleaf maple
<i>Aesculus californica</i>	California buckeye
<i>Arbutus menziesii</i>	madrone
<i>Arctostaphylos manzanita</i>	manzanita
<i>Camellia japonica</i>	Japanese camellia
<i>Camellia sasanqua</i>	Sasanqua camellia
<i>Hamamelis virginiana</i>	witch hazel
<i>Heteromeles arbutifolia</i>	toyon
<i>Lithocarpus densiflorus</i>	tanoak
<i>Lonicera hispidula</i>	California honeysuckle
<i>Pieris formosa</i>	Himalaya pieris
<i>Pieris formosa x japonica</i>	Pieris ‘Forest Flame’
<i>Pieris floribunda x japonica</i>	Pieris ‘Brouwer’s Beauty’
<i>Pieris japonica</i>	Japanese pieris
<i>Pseudotsuga menziesii var. menziesii</i>	Douglas-fir
<i>Quercus agrifolia</i>	coast live oak
<i>Quercus chrysolepis</i>	canyon live oak
<i>Quercus kelloggii</i>	California black oak
<i>Quercus parvula v. shrevei</i>	Shreve’s oak
<i>Rhamnus californica</i>	California coffeeberry
<i>Rhododendron spp.</i>	rhododendron (including azalea)
<i>Rosa gymnocarpa</i>	Wood’s rose
<i>Sequoia sempervirens</i>	coast redwood
<i>Trientalis latifolia</i>	western starflower
<i>Umbellularia californica</i>	California bay laurel, Oregon myrtle
<i>Vaccinium ovatum</i>	evergreen huckleberry
<i>Viburnum x bodnantense</i>	bodnant Viburnum
<i>Viburnum plicatum var. tomentosum</i>	doublefile Viburnum
<i>Viburnum tinus</i>	laurustinus

* Regulated plants are those adapted from other regulated lists or were added upon completion, documentation and review of traditional Kock’s postulates. Some are regulated in part (such as redwood and Douglas-fir); others are regulated in their entirety (such as tanoak and western star flower). Details on regulated articles can be found via links to “*Phytophthora ramorum* 7 CFR 301.92” and “Recent Modifications to *Phytophthora ramorum* Regulations” at www.aphis.usda.gov/ppq/isp/sod

Table 2. Plants Associated with *Phytophthora ramorum (in whole or part) - June 1, 2004 - see www.aphis.usda.gov/ppq/ispm/sod**

Scientific Name	Common Name
<i>Abies grandis</i>	grand fir
<i>Aesculus hippocastanum</i>	horse-chestnut
<i>Arbutus unedo</i>	strawberry tree
<i>Camellia reticulata</i>	Camellia
<i>Camellia x williamsii</i>	Camellia
<i>Castanea sativa</i>	sweet chestnut
<i>Corylus cornuta</i>	California hazelnut
<i>Fagus sylvatica</i>	European beech
<i>Kalmia latifolia</i>	mountain laurel
<i>Leucothoe fontanesiana</i>	drooping leucothoe
<i>Pieris formosa var. forrestii</i>	Chinese pieris
<i>Pieris formosa var. forrestii x Pieris japonica</i>	Pieris
<i>Pittosporum undulatum</i>	victorian box
<i>Pyracantha koidzumii</i>	Formosa firethorn
<i>Quercus cerris</i>	European turkey oak
<i>Quercus falcata</i>	southern red oak
<i>Quercus ilex</i>	Holm oak
<i>Quercus rubra</i>	northern red oak
<i>Rhamnus purshiana</i>	Cascara
<i>Rubus spectabilis</i>	salmonberry
<i>Syringa vulgaris</i>	lilac
<i>Taxus baccata</i>	European yew
<i>Toxicodendron diversiloba</i>	poison oak
<i>Vaccinium vitis-idaea</i>	lingonberry
<i>Viburnum davidii</i>	David Viburnum
<i>Viburnum farreri (=V. fragrans)</i>	fragrant Viburnum
<i>Viburnum lantana</i>	wayfaringtree Viburnum
<i>Viburnum opulus</i>	European cranberrybush Viburnum
<i>Viburnum x burkwoodii</i>	Burkwood Viburnum
<i>Viburnum x carlcephalum x V. utile</i>	viburnum
<i>Viburnum x pragense</i>	Prague Viburnum

* *Plants Associated with Phytophthora ramorum*: Associated plants are those found naturally infected from which *P. ramorum* has been cultured and/or detected using PCR (Polymerase Chain Reaction). For each of these, traditional Koch's postulates have not yet been completed or documented and reviewed.