REPORT TO THE CALIFORNIA OAK MORTALITY TASK FORCE
JANUARY 2003

RESEARCH

New findings were reported at the Sudden Oak Death Science Symposium, December 17-18, 2003 in Monterey, announcing that seven new plants in the United States and one in the United Kingdom (UK) have been found to be associated with *Phytophthora ramorum*. Regulatory agencies are still determining which newly identified plants and/or plant parts will be regulated. Some of the information announced at the Symposium was preliminary and tests must be repeated prior to publishing, but symptoms caused by *P. ramorum* were verified on the following species:

Plant	Common Name	State or Country	Confirmed by
Quercus chrysolepis	Canyon live oak	CA	Rizzo, UCD
Rhamnus purshiana	Cascara	OR	Hansen, OSU
Rubus spectabilis	Salmonberry	OR	Hansen, OSU
Toxicodendron diversilobum	Poison oak	OR	Hansen, OSU
Trientalis latifolia	Western starflower	CA	Huberli and Garbelotto - UCB
Pittosporum undulatum	Victorian box	CA	Garbelotto and Huberli- UCB
Corylus cornuta	California hazel	CA	Rizzo, UCD
Pieris (nursery stock)		England	Reported by Hunter, DEFRA

***Phytophthora nemorosa* - Over the past year or so, researchers and others surveying** for *P. ramorum* have found another new *Phytophthora* associated with cankers on oaks and California bay laurel leafspots. Previously referred to as *P. ilicis*-like, Everett Hansen and colleagues at Oregon State University are naming it *Phytophthora nemorosa*. The name won't be official until validly published in a mycology journal, hopefully sometime in 2003. The name "nemorosa" refers to the woodland habit of the pathogen.

P. nemorosa occurs in mixed woodlands along the Pacific Coast of North America, at least from San Diego to Coos Bay. It is not known to occur elsewhere. Typically it appears to be less virulent, usually associated with single tree mortality of oaks and tanoak and/or leafspots on California bay laurel. *P. ramorum* and *P. nemorosa* have occasionally been isolated from the same plant, but additional research is needed before the significance of this association is understood.

P. nemorosa is easily distinguished from *P. ramorum* when culturing, but not in the field. It prefers cooler temperatures and produces sexual spores, but not chlamydospores. The sporangia are similar. *P. ramorum* produces chlamydospores, but not sexual spores.

Currently a quarantine is not expected for *Phytophthora nemorosa* since it appears to be a native pathogen, not causing significant damage to the ecosystem.

Several other new *Phytophthoras* have also been found in the same ecological niche as *P. ramorum* and *P. nemorosa* and more are expected to be discovered. Prior to *P. ramorum*'s discovery, *Phytophthoras* in forests were investigated primarily as root diseases; *Phytophthora* was not suspected as the cause of symptoms on upper stems and leaves. The discovery that *Phytophthoras* may be present in foliage in temperate western forests has broadened the range of possible habitats for forest *Phytophthoras*.

MONITORING

***Phytophthora ramorum* has been recovered throughout European nurseries,** including the Netherlands, Germany, UK, France, Poland, Italy, Spain, Belgium, and Sweden as well as other countries. The organism has not been found on oaks in Europe, but is found on established rhododendron in public gardens.

In 2002, *P. ramorum* was recovered from approximately 140 nurseries (primarily on rhododendron and Viburnum) throughout the UK. The same nurseries were surveyed with the same methods last year at which time the pathogen was not found. The cause of this dramatic increase in positive nursery samples is being investigated. Change in weather patterns or fungicidal resistance are possible explanations.

Molecular studies of isolates from Europe indicate that the *Phythophthora ramorum* found in European countries is a different mating type from the isolates in California. These findings indicate that the pathogen probably did not move directly from California to Europe or vice-versa.

MANAGEMENT

Assemblywoman Patricia Wiggins convened a meeting on treatments for Sudden Oak Death at the Capitol on December 10, 2002. Matteo Garbelotto, UC Berkeley, presented his laboratory's progress on testing various pesticides for use against *Phytophthora ramorum* to several county agricultural commissioners, representatives from the California Department of Pesticide Regulation, California Department of Forestry and Fire Protection and USDA Forest Service. The Department of Pesticide Regulations will review the trials and product registration status and has agreed to expedite actions needed to register a material for use against *Phytophthora ramorum*. Currently there are **no** pesticides registered for use against *P. ramorum*. Any pesticide promoted, advertised, or intended to cure or prevent Sudden Oak Death must be registered and labeled for that use, site, and method of application, or it is illegal to use for that purpose. For additional information, contact your county agricultural commissioner or Regina Sarracino, California Department of Pesticide Regulation, at rsarracino@cdpr.ca.gov.

MEDIA COVERAGE

Media coverage of the Sudden Oak Death Science Symposium, the California Oak Mortality Task Force meeting, and the Pfeiffer Big Sur State Park field trip was extensive. The San Francisco Chronicle reported daily on issues surrounding *P. ramorum*. In addition, the Sacramento Bee covered the COMTF meeting and SOD Symposium extensively. Other media outlets reporting on the events included Science Magazine, the Contra Costa Times, the San Jose Mercury News, the Monterey Herald, KFBK (radio), Good Morning Monterey (radio), KCBS (radio), and the BBC (radio, England).

The December 2002 issue of Discover magazine's "If all the trees fall in the forest…" article follows the story of Sudden Oak Death from its discovery to the present. It discusses some of the scientific processes used to confirm the presence of *Phytophthora ramorum* as well as the unfolding of theories surrounding the disease, its origins, how it is spread, and its potential impacts.

The January 2003 Special Issue of Discover magazine focuses on "The Year in Science." The "100 Top Science Stories of 2002" are ranked and summarized. Sudden Oak Death was ranked as the 43rd top science story for 2002 and given a summary titled "Forest Plague Threatens Redwoods." The brief summary refers to the lengthy list of *P. ramorum* hosts, the virulence of the disease, and the heightened awareness of Sudden Oak Death with the additions of Douglas-fir and coast redwood to the list of affected plants.

TASK FORCE BUSINESS

The December 15 - 18, 2002 Sudden Oak Death Science Symposium, California Oak Mortality Task Force meeting, and field trip to Pfeiffer Big Sur State Park were attended by over 300 people from 13 countries and 26 states. The field trip provided many attendees with a first-time look at *P. ramorum* in the field, allowing for an interested and dynamic learning environment. Important updates on the direction of the Task Force for the coming year as well as the previous year's accomplishments were presented at the Task Force-wide meeting. The Science Symposium had 52 posters and 42 presentations on Sudden Oak Death related research projects. As Charles G. "Terry" Shaw noted in his summation of the Symposium, everything from ADAR (airborne data acquisition and registration) to AFLP (amplified fragment length polymorphisms) was covered, highlighting the broad technologies being used to examine this disease from a landscape perspective to genetic analysis. Throughout the course of the 4-day event, networking, sharing of information, and side meetings were in abundance with attendees excited at the opportunity to meet with peers and learning a great deal from one another.

DATES TO REMEMBER

6/28 – 29/03 – Jepson Herbarium weekend workshop; Sudden Oak Death weekend workshop with Dr. Matteo Garbelotto and Dr. Ellen Simms at the UC Botanical Gardens, Berkeley and five regions in the greater Bay Area; limited to 20 participants; contact Anneke Swinehart, Jepson Herbarium, (510) 643-7008

THE LEARNING CURVE

The following is an overview of the significance of the new plants found to be associated with *Phytophthora ramorum*.

Western starflower (*Trientalis latifolia*) (also known as Pacific starflower) is the first herbaceous plant to be confirmed as susceptible to *P. ramorum*. All previously recognized hosts have had woody tissue, although in some of the plants, such as California bay laurel, the leafy tissues of the trees or shrubs are known to serve as infection courts. The infected western starflower was found in Big Sur, Monterey County. Symptoms were numerous leaf spots (> 0.5 cm in diameter) surrounded by a yellow halo. *P. ramorum* culturing and confirmation via PCR and Koch's postulates has been completed (Huberli and others at UCB).

Canyon live oak or canyon oak *(Quercus chrysolepis)* - California oaks belong to three evolutionary lineages - white oaks, red oaks, and intermediate oaks (which share some of the features of both the red and white group). Until now, all known *P. ramorum* oak hosts have been red oaks. Canyon live oak is the first intermediate oak shown to be susceptible to *P. ramorum*.

Bleeding has been observed occasionally on canyon live oak in many areas with *P. ramorum*, but the presence of the pathogen was never confirmed until the successful isolation of *P. ramorum* from a shrubby canyon oak on Mt Tamalpais, Marin County. Canyon oak is the most widely distributed oak in California. It grows from Southwestern Oregon to Central Baja, although its geographic range extends east to Nevada and central Arizona. Its growth form and other characteristics vary greatly depending on its environment. A unique characteristic for identification is its bright green and shiny upper-surfaces of holly-like leaves, with lower surfaces that are pale blue or grayish. A felt of golden or silvery hair usually overlays the leaves and outer scales of the acorn.

***P. ramorum* was isolated from a variety of *Pieris* in a nursery in England. *Pieris* is in** the *Ericaceae* family and is known to be susceptible to a number of other *Phytophthora* species including *Phytophthora cinnamomi, P. citricola, P. citrophthora, P. parasitica*. In Oregon, Robert Linderman, USDA-Agricultural Research Service, Corvallis, tested the susceptibility of *Pieris japonica* via a detached leaf test. In his moist chamber study on needle-wounded leaves, the plants developed lesions that averaged less then 2 cm, indicating that relative to the other plants he tested, *Pieris japonica* showed "medium" susceptibility. *Pieris* is a common ornamental and wildland shrub in many parts of the US and Europe. It grows in deep shade, is deer resistant, and has attractive flowers making it a popular landscape shrub.

Poison oak (*Toxicodendron diversilobum)* - Poison oak is not a true oak since it does not produce acorns. Its flowers are insect pollinated and produce a fleshy berry. Poison oak is a widespread deciduous shrub throughout the mountains and valleys of California and is generally found below the 5,000 foot elevation; it is closely related to the cashew (family *Anacardiaceace*). It regenerates readily after disturbances such as fire and the

clearing of land and is considered an undesirable plant by many, given that more than 50 percent of humans are allergic to the oil it produces. In shady canyons and riparian habitats it commonly grows as a climbing vine with aerial (adventitious) roots that adhere to the trunks of oaks. It also forms dense thickets in chaparral and coastal sage scrub, particularly in central and northern California, extending the possible range for *P. ramorum* to coastal sage scrub.

Susceptibility of poison oak to *P. ramorum* confirmation was made by Everett Hansen, Oregon State University. His findings indicate that poison oak does not usually succumb to *P ramorum* infections.

There have been many observations in California of bleeding poison oak plants in infested coastal mixed evergreen forests. Ted Swiecki, Phytosphere Research, found that poison oak is among the most common shrubs in infested areas. He found a statistical association between the presence of poison oak in plots in Marin and Sonoma Counties and the presence of disease in adjacent trees. The statistical model from his plots suggests the possibility that poison oak, like bay, may be epidemiologically important, although it may only be important in years where rains extend late into the spring since poison oak is deciduous.

Cascara buckthorn, Cascara sagrada (*Rhamnus purshiana*) - *Phytophthora ramorum* was confirmed on cascara with leaf blight and shoot dieback on basal sprouts of trees adjacent to dying tanoak in the Brookings area, Curry County, OR. Symptoms were observed on cascara at several locations. Since the plants were in the Southern Oregon eradication area, they were cut and burned. Identification and confirmation was made by Everett Hansen's laboratory, Oregon State University.

Cascara is a deciduous, widespread, but not abundant, shrub or small tree found primarily in the forested mountains of the Pacific Northwest from British Columbia down through Northern California. It can grow up to 33 feet (10 m) and 10 to 20 inches in diameter at maturity, but becomes smaller and bushier along its southern distribution. It is mostly distributed west of the Cascades, but can also be found east to northern Idaho and northwestern Montana.

Cascara is used as browse by mule deer, black bear, gray fox, raccoon, ring-tailed cat, and other animals. Its drupes are eaten by five species of birds including the Oregon ruffed grouse and band-tailed pigeon.

The greatest known value of cascara is its purgative properties. In a single year, five million pounds of dried cascara bark from the Pacific Northwest was processed by pharmaceutical companies in the manufacture of laxatives. Its bark and fruits are used for medicinal purposes by many Tribes. (Background information summarized from USDA Forest Service, Fire Effects Information database http://www.fs.fed.us/database/feis.)

Salmonberry (*Rubus spectabilis*) - *Phytophthora ramorum* was confirmed on salmonberry where it caused limited leaf blight on plants adjacent to dying tanoak at one site in the Brookings area. Since the plants were in the Southern Oregon eradication area, they were cut and burned. Identification and confirmation was made by Everett Hansen's laboratory, Oregon State University.

Salmonberry is a shade-tolerant shrub with red, yellow, or orange "berries." The shrub is well represented in many Northwestern coniferous forests. It often forms dense patches within the understory of Douglas-fir and western hemlock forests. It also grows in mixed evergreen and hardwood forests as well as riparian forests. It grows in a wide range of sites, but is prevalent on mesic sites in forest openings, along waterways, roadsides, and disturbed sites.

Salmonberry provides important food and cover for a wide variety of birds and mammals. Tender, leafy new growth and berries are foraged by many mammals and birds. Nectar from the flowers provides food for bees and other insects, as well as for the rufous hummingbird.

Salmonberries are deliciously flavored, although somewhat variable in taste, and may be eaten fresh or preserved. The fruits make good jelly, but are too seedy for jam. Salmonberry fruit was traditionally an important food of many Native American peoples. Salmonberry is grown as an ornamental in gardens. (Background information summarized from USDA Forest Service, Fire Effects Information database http://www.fs.fed.us/database/feis.)

California Hazel, California hazelnut or California filbert (*Corylus cornuta* var. californica) - California hazel is an erect, deciduous, native, perennial shrub, or occasionally small tree. It is multi-stemmed and loosely spreading, averaging 5 to 12 feet (1.5-4 m) in height, yet it can exceed 20 feet (6 m) and develop a treelike form with a single trunk.

California hazelnut is typically found on moist, well-drained sites. It favors these conditions on north-facing slopes, along stream banks; in moist wooded canyons and slopes; in the understory of oak and conifer forests; and in open, burned or cut-over lands. California hazel occurs in California, Oregon, Washington, and British Columbia.

In some locations, California hazel is grazed extensively by livestock and wildlife--in others it is scarcely used. Utilization depends on the relative palatability and abundance of associated vegetation in a given area. Birds consume the buds and catkins. California hazelnuts are a staple food of the Steller's Jay, chickaree, Townsend's chipmunk, Allen's chipmunk, golden-mantled squirrel, and digger squirrel.

The edible nuts of California hazel have a sweet flavor and are commonly collected by people. The glandular hairs on the nut husk have been used as a remedy for parasitic intestinal worms. Native peoples used the slender 1- and 2-year-old twigs for basket

making. Background on California hazelnut is from http://plants.usda.gov. The PLANTS Database, USDA-Natural Resource Conservation Service.

Victorian box (*Pittosporum undulatum*) - In California, *Pittosporum undulatum* is an ornamental tree, common in Golden Gate Park and used as a street tree in many parts of the Bay Area. It grows to about 35 feet tall with fragrant clusters of pale yellowish flowers, similar to mock orange. It is native to New South Wales, in eastern Australia, and has been cultivated in California since the 1850's. Leafspot symptoms of *P. ramorum* on *Pittosporum undulatum* were first observed on the UC Berkeley campus (reported by the Garbelotto lab).