

Hosts of *Phytophthora ramorum*

(with notes on geographical distribution and mating types)

Causal Agent of SUDDEN OAK DEATH

IDENTITY

Name: *Phytophthora ramorum* Werres *et al.*
Synonyms: none
Taxonomic Position: Stramenopila; Subclass Oomycetes
Common Name: Sudden Oak Death (in oaks)

HOSTS

Initially observed in a limited number of oak species, *P. ramorum* is now known to infect a wide range of hosts in several plant families. In certain oak species, *i.e.*, *Quercus* spp. or *Lithocarpus* spp., symptoms of infection by *P. ramorum* may be quite dramatic, leading to the common name 'Sudden Oak Death'. In other hosts, symptoms are often restricted to leaf spots, stem and twig blight or occasionally seedling blight or tip dieback.

Table 1: Confirmed Natural Hosts of *Phytophthora ramorum*

These plant species have been found to be infected with P. ramorum under natural circumstances; they were found in parkland or forest settings, urban settings, gardens or nurseries during the course of surveys, research activities or other investigations.

Latin Name	Common Name(s)	Plant Family	Location	Reference
<i>Acer macrophyllum</i>	bigleaf maple	Aceraceae	North America	Garbelotto <i>et al.</i> , 2003
<i>Aesculus californica</i>	California buckeye	Hippocastanaceae	North America	Garbelotto <i>et al.</i> , 2003
<i>Arbutus menziesii</i> (probably multiple species)	arbutus, Pacific madrone	Ericaceae	North America	COMTF, 2001 Rizzo, 2003 Garbelotto <i>et al.</i> , 2003
<i>Arbutus unedo</i>	strawberry tree	Ericaceae	Europe -Spain	UK PRA, 2003
<i>Arctostaphylos manzanita</i>	manzanita	Ericaceae	North America	Garbelotto <i>et al.</i> , 2003
<i>Camellia japonica</i>	camellia japonica	Theaceae	Europe -UK North America - first report in NA of infection in this host was from nursery stock of several varieties at a Marin County nursery	UK PRA, 2003 COMTF June 2003
<i>Camellia sasanqua</i> cv. 'Bonanza'	sasanqua camellia cv. 'Bonanza'	Theaceae	North America - detected in 1- & 5-gallon containerized stock at several nurseries in CA	COMTF June 2003
<i>Camellia</i> sp.	unspecified ornamental camellia	Theaceae	Europe	DEFRA, 2003

Latin Name	Common Name(s)	Plant Family	Location	Reference
<i>Corylus cornuta</i>	beaked filbert California hazelnut	Betulaceae	North America	Murphy & Rizzo, 2002
<i>Heteromeles arbutifolia</i>	Christmas berry, toyon	Rosaceae	North America	Garbelotto <i>et al.</i> , 2003
<i>Kalmia latifolia</i>	mountain laurel	Ericaceae	Europe -UK	UK PRA, 2003
<i>Leucothoe fontanesiana</i>			Europe - UNCONFIRMED REPORT	UK PRA, 2003
<i>Lithocarpus densiflorus</i>	tanoak, tanbark oak	Fagaceae	North America	Storer <i>et al.</i> , 2001 Garbelotto <i>et al.</i> , 2001 Rizzo <i>et al.</i> , 2002 Garbelotto <i>et al.</i> , 2003
<i>Lonicera hispidula</i>	California honeysuckle, hairy honeysuckle, pink honeysuckle	Caprifoliaceae	North America	COMTF, November 2001
<i>Pieris formosa</i> var. <i>forrestii</i>	Chinese pieris Himalayan pieris	Ericaceae	Europe -UK	UK PRA, 2003
<i>Pieris japonica</i>	Japanese pieris	Ericaceae	Europe -UK North America -isolated from potted plant in vicinity of heavily infected bay in CA - detected in containerized stock in an OR nursery - 'Variegata' and 'Flaming Silver'	UK PRA, 2003 COMTF, March 2003 ODA, 2003
<i>Pieris</i> sp.	unspecified evergreen shrub cultivated in Europe; genus is native to North America & Asia	Ericaceae	Europe North America - detected in containerized <i>P. japonica</i> X <i>formosa</i> hybrid stock in an OR nursery - 'Forest Flame'	DEFRA, 2003 ODA, 2003
<i>Pittosporum undulatum</i>	Victorian box	Pittosporaceae	North America - detected by PCR from CA material; lesions present but isolation unsuccessful	Huberli, pers. comm.
<i>Pseudotsuga menziesii</i>	Douglas-fir	Pinaceae	North America	Davidson <i>et al.</i> , 2002 Garbelotto <i>et al.</i> , 2003
<i>Quercus agrifolia</i>	coast live oak	Fagaceae	North America	Storer <i>et al.</i> , 2001 Garbelotto <i>et al.</i> , 2001 Rizzo <i>et al.</i> , 2002 Garbelotto <i>et al.</i> , 2003
<i>Quercus chrysolepis</i>	canyon live oak	Fagaceae	North America	Murphy & Rizzo, 2003

Latin Name	Common Name(s)	Plant Family	Location	Reference
<i>Quercus kelloggii</i>	black oak	Fagaceae	North America	Storer <i>et al.</i> , 2001 Garbelotto <i>et al.</i> , 2001 Rizzo <i>et al.</i> , 2002 Garbelotto <i>et al.</i> , 2003
<i>Quercus parvula</i> var. <i>shrevei</i>	Shreve's oak	Fagaceae	North America	Storer <i>et al.</i> , 2001 Rizzo <i>et al.</i> , 2002
<i>Rhamnus californica</i>	coffeeberry	Rhamnaceae	North America	Garbelotto <i>et al.</i> , 2003
<i>Rhamnus purshiana</i>	cascara	Rhamnaceae	North America	Goheen <i>et al.</i> , 2002
<i>Rhododendron brachycarpum</i>	rhododendron	Ericaceae	Europe	UK PRA, 2003
<i>Rhododendron catawbiense</i>	rhododendron hybrids 'Catawbiense Boursault', 'Catawbiense Grandiflorum', 'Everestianum' & 'Roseum Elegans'	Ericaceae	Europe -Germany North America	UK PRA, 2003 Werres <i>et al.</i> , 2001 Rizzo, 2003
<i>Rhododendron caucasicum</i>	rhododendron	Ericaceae	Europe	UK PRA, 2003
<i>Rhododendron ferrugineum</i>	rhododendron	Ericaceae	Europe	UK PRA, 2003
<i>Rhododendron macrophyllum</i>	Pacific rhododendron	Ericaceae	North America	Goheen <i>et al.</i> , 2002 Rizzo, 2003
<i>Rhododendron ponticum</i>	rhododendron	Ericaceae	Europe	UK PRA, 2003
<i>Rhododendron repens</i>	rhododendron	Ericaceae	Europe	UK PRA, 2003
<i>Rhododendron yakushimanum</i>	rhododendron	Ericaceae	Europe	UK PRA, 2003 De Merlier <i>et al.</i> , 2003
<i>Rhododendron</i> spp	rhododendron, azalea	Ericaceae	Europe North America	Storer <i>et al.</i> , 2001 Werres <i>et al.</i> , 2001 Maralejo & Werres, 2002
<i>Rhododendron</i> sp.	rhododendron 'Unique'	Ericaceae	North America - confirmed in containerized nursery stock in nurseries in OR & BC – 'Unique' - A1 (European) mating type	ODA, 2003 CFIA News Release
<i>Rhus diversiloba</i>	poison oak	Anacardiaceae	North America	Goheen <i>et al.</i> , 2002
<i>Rubus spectabilis</i>	salmon berry	Rosaceae	North America	Goheen <i>et al.</i> , 2002
<i>Sequoia sempervirens</i>	coast redwood	Taxodiaceae	North America	Maloney <i>et al.</i> , 2002 Garbelotto <i>et al.</i> , 2003
<i>Syringa</i> sp.	lilac	Oleaceae	Europe	UK DEFRA, 2003

Latin Name	Common Name(s)	Plant Family	Location	Reference
<i>Toxicodendron diversilobum</i>	poison oak	Anacardiaceae	North America	Rizzo, 2003
<i>Trientalis latifolia</i>	pacific or western starflower	Primulaceae	North America -confirmed in Monterey County, CA	Hüberli <i>et al.</i> , 2003
<i>Umbellularia californica</i>	California bay, California laurel, bay laurel, myrtle, pepperwood	Lauraceae	North America	Garbelotto <i>et al.</i> , 2003
<i>Vaccinium ovatum</i>	evergreen huckleberry	Ericaceae	North America	Storer <i>et al.</i> , 2001 Goheen <i>et al.</i> , 2002 Garbelotto <i>et al.</i> , 2003
<i>Vaccinium vitis-idaea</i>	lignoberry	Ericaceae	Europe -detected on imported material (source unknown) in Poland	Orlikowski & Szkuta, 2002
<i>Viburnum X bodnantense</i>	Hybrid between <i>V. farreri</i> & <i>V. grandiflorum</i>	Caprifoliaceae	Europe -basal cankers develop but leaf lesions are not observed in field situations suggesting the possibility that infection occurs through the roots in this host; leaf & stem inoculation assays were unsuccessful in initiating infection North America - detected in containerized stock at an OR nursery - 'Dawn'	Werres <i>et al.</i> , 2001 Husson <i>et al.</i> , 2003 de Gruyter <i>et al.</i> , 2003 De Merlier <i>et al.</i> , 2003 ODA, 2003
<i>Viburnum X burkwoodii</i>	Hybrid between <i>V. carlesii</i> & <i>V. utile</i>	Caprifoliaceae	Europe	UK PRA, 2003
<i>Viburnum davidii</i>	Viburnum	Caprifoliaceae	Europe	UK PRA, 2003
<i>Viburnum farreri</i>	Viburnum	Caprifoliaceae	Europe	UK PRA, 2003
<i>Viburnum fragans</i>	Viburnum	Caprifoliaceae	Europe	Rizzo, 2003
<i>Viburnum opulus</i>	Viburnum	Caprifoliaceae	Europe	UK PRA, 2003
<i>Viburnum plicatum</i>	Viburnum	Caprifoliaceae	Europe	UK PRA, 2003
<i>Viburnum plicatum tomentosum</i>	doublefile viburnum	Caprifoliaceae	North America - confirmed on containerized nursery stock in an OR nursery - 'Mariesii'	ODA, 2003
<i>Viburnum tinus</i>	Viburnum	Caprifoliaceae	Europe	Lane <i>et al.</i> , 2002; Husson <i>et al.</i> , 2003
<i>Viburnum</i> spp.	Viburnum	Caprifoliaceae	Europe	Werres <i>et al.</i> , 2001 Husson <i>et al.</i> , 2003
<i>Viburnum</i> sp. 'Schneewolke'	Viburnum	Caprifoliaceae	Europe	Werres <i>et al.</i> , 2001

Table 2: Assays of Susceptibility to *P. ramorum*

These plant species have been artificially inoculated with *Phytophthora ramorum* using various methods to assess their susceptibility to infection by the pathogen. As noted, some, but not all, have been shown to be variably susceptible to infection under the test conditions, i.e., the fungus can be introduced to each artificially and subsequently become established causing symptoms of infection to develop. Various experimental designs and inoculation methods, and different ways of measuring susceptibility have been used by different authors, so direct comparisons or absolute measures of susceptibility are difficult to make. In addition, mating type of the test isolates is not always reported, but origin(s) of the specimen(s) may give some indication of the probable mating type. Some of these hosts are also natural hosts and are included in the above table, but others have not been found infecting hosts under natural conditions. Additional information is needed to determine the extent to which susceptible species could be affected by *Phytophthora ramorum* and the role they may play in the epidemiology of sudden oak death.

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Acer</i> spp.	maple	Aceraceae	North American & European isolates tested; no significant differences; slightly susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Acer campestre</i>	field or hedge maple	Aceraceae	mating type not specified, both American & European types used in study - results of leaf inoculation assays indicate resistance	UK PRA, 2003
<i>Acer palmatum</i>	Japanese maple	Aceraceae	North American isolates, detached leaf assay results indicate high susceptibility	Parke <i>et al.</i> , 2002
<i>Acer pseudoplatanus</i>	sycamore	Aceraceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "less" susceptibility Results of leaf inoculation assays indicate slight susceptibility	UK PRA, 2003 Brasier <i>et al.</i> , 2002 UK PRA, 2003
<i>Aesculus hippocastanum</i>	horse chestnut	Hippocastanaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "less" susceptibility	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Alnus glutinosa</i>	European alder black alder	Betulaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "less" susceptibility results of leaf inoculation assay indicate potential to be resistant	UK PRA, 2003 Brasier <i>et al.</i> , 2002 UK PRA, 2003
<i>Alnus</i> spp.	alder	Betulaceae	mating type not specified - results of leaf inoculation assays indicate potential resistance or immunity	Inman <i>et al.</i> , 2002
<i>Arbutus unedo</i>	strawberry tree	Ericaceae	mating type & origin of isolate not stated, work conducted in Spain - detached leaf assay results indicate high susceptibility, conspicuous necrotic lesions were apparent 72 hours after inoculation, extensive blight developed in 9 days	Moralejo & Hernandez, 2002
<i>Arctostaphylos uva-ursi</i>	bearberry	Ericaceae	Californian isolate 0-217 & type culture 9/95 (European), detached leaf assays resulted in mean lesion area of 10.2% total leaf surface	Tooley & Englander, 2002

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Arctostaphylos uva-ursi</i>	common bearberry	Ericaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be moderately susceptible	UK PRA, 2003
<i>Arctostaphylos</i> spp.	bearberry	Ericaceae	North American & European isolates tested; no significant differences; potentially moderately susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Aucuba japonica</i>	Japanese laurel	Aucubaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003
<i>Betula pubescens</i>	European birch downy birch	Betulaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "less" susceptibility	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Buddleia davidii</i>	butterfly bush, summer lilac	Loganiaceae	North American isolates, detached leaf assay results indicate high susceptibility North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	Parke <i>et al.</i> , 2002 UK PRA, 2003
<i>Calluna</i> sp.	heath	Ericaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003
<i>Camellia japonica</i>	common camellia	Ericaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be highly susceptible	UK PRA, 2003
<i>Camellia japonica</i>	common camellia	Ericaceae	mating type and origin of isolate(s) not stated, work conducted in North America - <i>V. davidii</i> essentially not susceptible in detached leaf assays	Linderman <i>et al.</i> , 2002
<i>Camellia</i>	camellia	Ericaceae	North American & European isolates tested; no significant differences; potentially highly susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Carpinus betula</i>	hornbeam	Corylaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "resistant"	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Castanea sativa</i>	sweet chestnut	Fagaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "less" susceptibility in some trials and "more" susceptibility in repeat trials with extensive bleeding observed on logs 3 weeks after inoculation; bark may be more resistant than that of <i>Quercus rubra</i>	UK PRA, 2003 Brasier <i>et al.</i> , 2002 Brasier <i>et al.</i> , 2003

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Castanopsis chryophylla</i>	giant chinquapin, giant chinkapin, golden chinkapin	Fagaceae	North American isolates - reaction as great as on tanoak in log inoculation studies	Hansen & Sutton, 2002
<i>Ceanothus impressus</i>	Californian lilac, Santa Barbara	Rhamnaceae	North American isolates, detached leaf assay results indicate high susceptibility	Parke <i>et al.</i> , 2002
<i>Ceratonia siliqua</i>	carob	Leguminosae	mating type & origin of isolate not stated, work conducted in Spain - detached leaf assay results indicate high susceptibility, conspicuous necrotic lesions were apparent 72 hours after inoculation, extensive blight developed in 9 days	Moralejo & Hernandez, 2002
<i>Chaenomeles speciosa</i>	flowering quince	Rosaceae	North American (Oregon) isolates, mating type not stated - no symptoms were observed following detached leaf assays	Parke <i>et al.</i> , 2002
<i>Chamaecyparis lawsoniana</i>	Port-Orford cedar, Lawson's cypress	Pinaceae	North American isolates - reaction as great as on tanoak in log inoculation studies	Hansen & Sutton, 2002
<i>Chamaecyparis lawsoniana</i>	Port-Orford cedar, Lawson's cypress	Pinaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "more" susceptibility	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Chimaphila umbellata</i>	common prince's pine ground holly wintergreen	Pyrolaceae	mating type & isolate origin not stated, probably OR isolate - detached leaf assay resulted in leaf necrosis indicating susceptibility	Zanzot <i>et al.</i> , 2002
<i>Choisya ternata</i>	Mexican orange blossom	Rutaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003
<i>Cistus salvifolius</i>	rock rose	Cistaceae	mating type & origin of isolate not stated, work conducted in Spain - results of detached leaf assays indicate susceptibility to <i>P. ramorum</i>	Moralejo & Hernandez, 2002
<i>Clematis flammula</i>	fragrant virgin's bower	Ranunculaceae	mating type & origin of isolate not stated, work conducted in Spain - results of detached leaf assays indicate no susceptibility to <i>P. ramorum</i>	Moralejo & Hernandez, 2002
<i>Clematis montana</i>	anemone clematis	Ranunculaceae	North American isolates, detached leaf assay results indicate high susceptibility leaf inoculation studies, using both NA & EU isolates, indicate potential to be resistant	Parke <i>et al.</i> , 2002 UK PRA, 2003
<i>Cornus alba</i>	tartarian white dogwood	Cornaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be resistant	UK PRA, 2003
<i>Cornus florida</i>	flowering dogwood	Cornaceae	North American (Oregon) isolates, mating type not stated - no symptoms were observed following detached leaf assays	Parke <i>et al.</i> , 2002

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Corylus avellana</i>	filbert hazel	Corylaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be resistant	UK PRA, 2003
<i>Corylus</i> spp.	hazel	Corylaceae	mating type not specified - results of leaf inoculation assays indicate potential resistance or immunity	Inman <i>et al.</i> , 2002
<i>Cotoneaster multiflorus</i>	cotoneaster	Rosaceae	North American (Oregon) isolates, mating type not stated - no symptoms were observed following detached leaf assays	Parke <i>et al.</i> , 2002
<i>Crataegus monogyna</i>	hawthorn	Rosaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be resistant	UK PRA, 2003
<i>Crataegus</i> spp.	hawthorn	Rosaceae	mating type not specified - results of leaf inoculation assays indicate potential resistance or immunity	Inman <i>et al.</i> , 2002
<i>Erica cinerea</i>	heather	Ericaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be resistant	UK PRA, 2003
<i>Eucalyptus</i>	eucalyptus gum	Myrtaceae	North American & European isolates tested; no significant differences; potentially highly susceptible spp. in genus	Inman <i>et al.</i> , 2002 UK PRA, 2003
<i>Fagus sylvatica</i>	European beech	Fagaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "more" susceptibility; in some tests, extensive bleeding was observed on inoculated logs after 3 weeks incubation; bark may be relatively more susceptible than that of <i>Quercus robur</i>	UK PRA, 2003 Brasier <i>et al.</i> , 2002 Brasier <i>et al.</i> , 2003
<i>Fagus sylvatica</i>	European beech	Fagaceae	North American & European isolates tested, no distinction in results reported - susceptible; young plants inoculated through stem or leaf tissue exhibited severed twig dieback after 4 weeks	de Gruyter <i>et al.</i> , 2002
<i>Forsythia</i> sp.	golden bells	Oleaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003
<i>Fraxinus excelsior</i>	European ash	Oleaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "resistant"	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Fuchsia</i>	fuschia	Onagraceae	North American & European isolates tested; no significant differences; potentially moderately susceptible spp. in genus	Inman <i>et al.</i> , 2002

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Gaultheria X wisleyensis</i>	gaultheria	Ericaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be slightly susceptible	UK PRA, 2003
<i>Gaultheria shallon</i>	salal	Ericaceae	mating type and origin of isolate(s) not stated, work conducted in North America - <i>V. davidii</i> not susceptible in detached leaf assays	Linderman <i>et al.</i> , 2002
<i>Gaultheria</i>	wintergreen	Ericaceae	North American & European isolates tested; no significant differences; slightly susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Gleditsia triacanthos</i>	honeylocust	Fabaceae	North American isolates, detached leaf assay results indicate high susceptibility	Parke <i>et al.</i> , 2002
<i>Hamamelis vernalis</i>	vernal witchhazel	Styracaceae	North American isolates, detached leaf assay results indicate high susceptibility	Parke <i>et al.</i> , 2002
<i>Hedera helix</i>	English ivy	Araliaceae	mating type and origin of isolate(s) not stated, work conducted in North America - <i>V. davidii</i> not susceptible in detached leaf assays	Linderman <i>et al.</i> , 2002
<i>Humulus lupulus</i>	golden hop	Cannabinaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003
<i>Hypericum</i> 'Hidcote'	St. John's-wort	Hypericaceae	North American (Oregon) isolates, mating type not stated - no symptoms were observed following detached leaf assays	Parke <i>et al.</i> , 2002
<i>Ilex aquifolium</i>	holly	Aquifoliaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be resistant	UK PRA, 2003
<i>Ilex aquifolium</i>	holly	Aquifoliaceae	mating type and origin of isolate(s) not stated, work conducted in North America - <i>V. davidii</i> essentially not susceptible in detached leaf assays	Linderman <i>et al.</i> , 2002
<i>Ilex</i> spp.	holly	Aquifoliaceae	mating type not specified - results of leaf inoculation assays indicate potential resistance or immunity	Inman <i>et al.</i> , 2002
<i>Kalmia latifolia</i>	mountain laurel 'Madeline'	Ericaceae	Californian isolate 0-217 & type culture 9/95 (European) - detached leaf assays resulted in mean lesion area of 31.8% total leaf surface	Tooley & Englander, 2002
<i>Kalmia latifolia</i>	mountain laurel	Ericaceae	mating type and origin of isolate unknown - inoculation with isolates intercepted from rhododendron (origin unknown) indicate susceptibility	Orlikowski & Szkuta, 2002
<i>Laurus nobilis</i>	English bay laurel	Lauraceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Lavatera</i> sp.	tree mallow	Malvaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003
<i>Leucothoe</i>	fetterbush	Ericaceae	North American & European isolates tested; no significant differences; potentially highly susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Ligustrum</i> sp.	hedge privet	Oleaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be resistant	UK PRA, 2003
<i>Linnaea borealis</i>	twinflower	Caprifoliaceae	mating type & isolate origin not stated, probably OR isolate - detached leaf assay resulted in leaf necrosis indicating susceptibility	Zanzot <i>et al.</i> , 2002
<i>Lonicera implexa</i>	honeysuckle	Caprifoliaceae	mating type & origin of isolate not stated, work conducted in Spain - detached leaf assay results indicate high susceptibility, conspicuous necrotic lesions were apparent 72 hours after inoculation, extensive blight developed in 9 days	Moralejo & Hernandez, 2002
<i>Lonicera periclymenum</i>	honeysuckle	Caprifoliaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be resistant young plants inoculated through stem or leaf with NA or EU isolates were unaffected after 4 weeks	UK PRA, 2003 deGruyter <i>et al.</i> , 2002
<i>Malus sylvestris</i>	crab apple	Rosaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be slightly susceptible	UK PRA, 2003
<i>Malus</i>	Apple	Rosaceae	North American & European isolates tested; no significant differences; slightly susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Morus</i> sp.	mulberry	Moraceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003
<i>Olea europea</i>	Olive	Oleaceae	mating type & origin of isolate not stated, work conducted in Spain - detached leaf assay results indicate high susceptibility, conspicuous necrotic lesions were apparent 72 hours after inoculation, extensive blight developed in 9 days	Moralejo & Hernandez, 2002
<i>Oxydendrum arboreum</i>	Sourwood	Ericaceae	North American isolates, detached leaf assay results indicate high susceptibility	Parke <i>et al.</i> , 2002
<i>Pachysandra terminalis</i>	Japanese pachysandra	Buxaceae	mating type and origin of isolate(s) not stated, work conducted in North America - <i>V. davidii</i> essentially not susceptible in detached leaf assays	Linderman <i>et al.</i> , 2002

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Philadelphus coronarius</i>	mockorange	Saxifragaceae	North American (Oregon) isolates, mating type not stated - no symptoms were observed following detached leaf assays	Parke <i>et al.</i> , 2002
<i>Photinia serrulata</i>	Chinese photinia	Rosaceae	North American (Oregon) isolates, mating type not stated - no symptoms were observed following detached leaf assays	Parke <i>et al.</i> , 2002
<i>Photinia</i>	Christmas berry	Rosaceae	North American & European isolates tested; no significant differences; potentially moderately susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Picea sitchensis</i>	Sitka spruce	Pinaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "more" susceptibility	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Pieris floribunda</i>	fetterbush	Ericaceae	Californian isolate 0-217 & type culture 9/95 (European), detached leaf assays resulted in mean lesion area of 27.8% total leaf surface	Tooley & Englander, 2002
<i>Pieris japonica</i>	lily-of-the-valley bush	Ericaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be highly susceptible	UK PRA, 2003
<i>Pieris japonica</i>	lily-of-the-valley bush	Ericaceae	mating type and origin of isolate unknown - inoculation with isolates intercepted from rhododendron (origin unknown) indicate susceptibility	Orlikowski & Szkuta, 2002
<i>Pieris</i> spp.	pieris	Ericaceae	North American & European isolates tested; no significant differences; potentially highly susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Pistacia lentiscus</i>	evergreen pistache mastic tree	Anacardiaceae	mating type & origin of isolate not stated, work conducted in Spain - detached leaf assay results indicate high susceptibility, conspicuous necrotic lesions were apparent 72 hours after inoculation, extensive blight developed in 9 days	Moralejo & Hernandez, 2002
<i>Populus</i> sp.	poplar	Salicaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "resistant"	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Prunus laurocerasus</i>	cherry laurel English laurel	Rosaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "less" susceptibility leaf inoculation assay results indicate slight susceptibility	UK PRA, 2003 Brasier <i>et al.</i> , 2002 UK PRA, 2003
<i>Prunus lusitanica</i>	Portugal laurel	Rosaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be slightly susceptible	UK PRA, 2003

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Prunus persicae</i>	nectarine	Rosaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be slightly susceptible	UK PRA, 2003
<i>Prunus</i> spp.	stonefruits	Rosaceae	North American & European isolates tested; no significant differences; slightly susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Pseudotsuga menzeisii</i>	Douglas-fir	Pinaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "more" susceptibility	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Quercus cerris</i>	Turkey oak	Fagaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "more susceptible" to 2 EU isolates and "less susceptible" to 2 NA isolates	Brasier <i>et al.</i> , 2002
<i>Quercus chrysolepis</i>	California black oak	Fagaceae	North American isolates - reaction much less than on tanoak in log inoculation studies, small lesions developed following inoculation	Hansen & Sutton, 2002
<i>Quercus douglasii</i>	Blue oak	Fagaceae	North American isolates - no canker development was observed four months after inoculating seedlings, although the fungus remained viable & could be re-isolated.	Rizzo, unpublished
<i>Quercus garryana</i>	Oregon white oak, Garry oak	Fagaceae	North American isolates - reaction much less than on tanoak in log inoculation studies, small lesions developed following inoculation	Hansen & Sutton, 2002
<i>Quercus ilex</i>	holm oak	Fagaceae	A1 & A2 - amongst the most susceptible European forest spp.	Brasier <i>et al.</i> , 2002
<i>Quercus ilex</i>	holm oak	Fagaceae	mating type & origin of test isolates not stated, work conducted in Spain - results of detached leaf assays indicate susceptibility, limited lesion development after 9 days but the organism could be re-isolated	Moralejo & Hernandez, 2002
<i>Quercus kelloggii</i>	California black oak	Fagaceae	North American isolates - reaction much less than on tanoak in log inoculation studies, small lesions developed following inoculation	Hansen & Sutton, 2002
<i>Quercus lobata</i>	valley oak California white oak	Fagaceae	North American isolates - no canker development was observed four months after inoculating seedlings, although the fungus remained viable & could be re-isolated.	Rizzo, unpublished
<i>Quercus palustris</i>	northern pin oak	Fagaceae	Californian isolates, mating type not stated	Rizzo ¹ , unpublished

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David Rizzo, Department of Plant Pathology, University of California, Davis, CA. Data presented at 2001 Western International Forest Disease Work Conference, 10 - 14 September 2001, Carmel, California.

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Quercus robur</i>	English oak pedunculate oak	Fagaceae	French isolate, mating type not stated - moderate susceptibility, all plants produced bark necrosis with occasional bleeding but necrosis on inoculated leaves was rare; less susceptible than <i>Q. agrifolia</i> & <i>L. densiflorus</i>	Delatour <i>et al.</i> , 2002
<i>Quercus robur</i>	English oak pedunculate oak	Fagaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "less" susceptibility; preliminary results indicate that bark is more resistant to infection than is the bark of <i>Quercus rubra</i>	UK PRA, 2003 Brasier <i>et al.</i> , 2002 Brasier <i>et al.</i> , 2003
<i>Quercus robur</i>	English oak pedunculate oak	Fagaceae	North American & European isolates tested, no distinction in results reported - young plants inoculated through stem or leaf tissue showed no symptoms after 4 weeks, resistant	de Gruyter <i>et al.</i> , 2002
<i>Quercus rubra</i>	red oak	Fagaceae	Californian isolates, mating type not stated	Rizzo ¹ , unpublished
<i>Quercus rubra</i>	red oak	Fagaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "more" susceptibility	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Quercus rubra</i>	red oak	Fagaceae	North American & European isolates tested, no distinction in results reported - susceptible; young plants inoculated through stem or leaf tissue exhibited severed twig dieback after 4 weeks	de Gruyter <i>et al.</i> , 2002
<i>Quercus suber</i>	cork oak	Fagaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "less" susceptibility	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Rhamnus alaternus</i>	Italian buckthorn evergreen buckthorn	Rhamnaceae	mating type & origin of isolate not stated, work conducted in Spain - detached leaf assay results indicate high susceptibility, conspicuous necrotic lesions were apparent 72 hours after inoculation, extensive blight developed in 9 days	Moralejo & Hernandez, 2002
<i>Rhaphiolepis umbellata</i>	round-leaf hawthorn	Rosaceae	North American (Oregon) isolates, mating type not stated - no symptoms were observed following detached leaf assays	Parke <i>et al.</i> , 2002
<i>Rhododendron japonicum</i>	azalea	Ericaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be resistant	UK PRA, 2003
<i>Rhododendron maximum</i>	rhododendron	Ericaceae	Californian isolate 0-217 & type culture 9/95 (European), detached leaf assays resulted in mean lesion area of 5.9% total leaf surface	Tooley & Englander, 2002
<i>Rhododendron occidentale</i>	western azalea	Ericaceae	mating type not specified, Californian isolate probable - highly susceptible in detached leaf assay	Tjosvold <i>et al.</i> , 2002

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Rhododendron ponticum</i>	rhododendron	Ericaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "more" susceptibility 1-2 year old seedlings developed severe leaf & stem lesions following inoculation with either EU or NA isolates; very susceptible	UK PRA, 2003 Brasier <i>et al.</i> , 2002 de Gruyter <i>et al.</i> , 2002
<i>Rhododendron simsii</i>	Sim's azalea	Ericaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be resistant	UK PRA, 2003
<i>Rhododendron</i>	'Girard's rose' azalea	Ericaceae	Californian isolate 0-217 & type culture 9/95 (European), detached leaf assays resulted in mean lesion area of 15.9% total leaf surface	Tooley & Englander, 2002
<i>Rhododendron</i>	azalea 'Northern Hilites'	Ericaceae	mating type not specified, Californian isolate probable - highly susceptible in detached leaf assay	Tjosvold <i>et al.</i> , 2002
<i>Rhododendron</i>	rhododendron 'Cunningham's white'	Ericaceae	mating type not specified, Californian isolate probable - highly susceptible in detached leaf assay	Tjosvold <i>et al.</i> , 2002
<i>Rhododendron</i>	rhododendron 'Cunningham's white'	Ericaceae	Californian isolate 0-217 & type culture 9/95 (European), detached leaf assays resulted in mean lesion area of 17.4% total leaf surface	Tooley & Englander, 2002
<i>Rhododendron</i>	florist's azalea 'Inga'	Ericaceae	Californian isolate 0-217 & type culture 9/95 (European), detached leaf assays resulted in mean lesion area of 4.4% total leaf surface	Tooley & Englander, 2002
<i>Rhododendron</i>	rhododendron 'Exbury' hybrids	Ericaceae	North American isolates, detached leaf assay results indicate high susceptibility	Parke <i>et al.</i> , 2002
<i>Rhododendron</i>	azaleas	Ericaceae	North American & European isolates tested; no significant differences; slightly susceptible spp. in genus Deciduous azaleas were generally more susceptible in detached leaf assay studies than were evergreen azaleas similarly challenged. detached leaf assays with both NA & EU isolates indicate potential to be virtually immune	Inman <i>et al.</i> , 2002 Tjosvold <i>et al.</i> , 2002 UK PRA, 2003
<i>Ribes sanguineum</i>	flowering currant, winter currant	Grossulariaceae	North American isolates, detached leaf assay results indicate high susceptibility	Parke <i>et al.</i> , 2002
<i>Rosa sempervirens</i>	evergreen rose	Rosaceae	mating type & origin of isolates not stated, work conducted in Spain - detached leaf assay results indicate susceptibility, no further details	Moralejo & Hernandez, 2002

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Rubus fruticosus</i>	bramble	Rosaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003 Inman <i>et al.</i> , 2002
<i>Rubus ulmifolius</i>	blackberry	Rosaceae	mating type & origin of isolates not stated, work conducted in Spain - results of detached leaf assays indicate no susceptibility to <i>P. ramorum</i>	Moralejo & Hernandez, 2002
<i>Sambucus racemosa</i>	red-berried elder	Caprifoliaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be highly susceptible	UK PRA, 2003
<i>Sambucus nigra</i>	common elder	Caprifoliaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be highly susceptible	UK PRA, 2003
<i>Sambucus</i> spp.	elderberry	Caprifoliaceae	North American & European isolates tested; no significant differences; potentially highly susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Sequoia sempervirens</i>	coast redwood	Taxodiaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "less" susceptibility	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Skimmia japonica</i>	Japanese skimmia	Rutaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003
<i>Smilax aspersa</i>	greenbrier	Liliaceae	mating type & origin of isolates not stated, work conducted in Spain - detached leaf assay results indicate susceptibility, no further details	Moralejo & Hernandez, 2002
<i>Spiraea japonica</i>	Japanese spirea	Rosaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003
<i>Symphoricarpus albus</i>	snowberry	Caprifoliaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be moderately susceptible	UK PRA, 2003
<i>Symphoricarpus</i>	snowberry	Caprifoliaceae	North American & European isolates tested; no significant differences; potentially moderately susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Syringa</i>	lilac	Myrtaceae	North American & European isolates tested; no significant differences; potentially highly susceptible spp. in genus	Inman <i>et al.</i> , 2002 UK PRA, 2003
<i>Taxus baccata</i>	yew	Taxaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "less" susceptibility	UK PRA, 2003 Brasier <i>et al.</i> , 2002

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Tilia cordata</i>	small-leaved lime	Tiliaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "resistant"	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Ulmus glabra</i>	Wych elm	Ulmaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be moderately susceptible	UK PRA, 2003
<i>Ulmus procera</i>	English elm	Ulmaceae	mating type not specified, both American & European types used in study - results of inner bark inoculations indicate "resistant"	UK PRA, 2003 Brasier <i>et al.</i> , 2002
<i>Ulmus</i>	ornamental yellow-leaved Scots elm	Ulmaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be moderately susceptible	UK PRA, 2003
<i>Ulmus</i>	elm	Ulmaceae	North American & European isolates tested; no significant differences; potentially moderately susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Vaccinium corymbosum</i>	blueberry	Ericaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be resistant	UK PRA, 2003
<i>Vaccinium myrtillus</i>	European wild blueberry	Ericaceae	North American & European isolates tested, no distinction in results reported - susceptible; young plants inoculated through stem or leaf tissue died within 4 weeks	de Gruyter <i>et al.</i> , 2002
<i>Vaccinium parviflorum</i>	red huckleberry	Ericaceae	mating type & isolate origin not stated, probably OR isolate - detached leaf assay resulted in leaf necrosis indicating susceptibility	Zanzot <i>et al.</i> , 2002
<i>Vaccinium</i> spp., including <i>V. corymbosum</i> and <i>V. corymbosum</i> X <i>V. angustifolium</i>	commercial blueberry	Ericaceae	North American isolates, mating type not stated - results of detached leaf assays indicate a range of susceptibility amongst commercial & wild species of <i>Vaccinium</i> from resistant (cranberry) to highly susceptible (lignoberry)	Parke <i>et al.</i> , 2002b
<i>Vaccinium vitis-idaea</i>	lignoberry	Ericaceae (heath family)	North American isolates, mating type not stated - results of detached leaf assays indicate susceptibility (Note that this species has been found to be naturally infected in Europe, see Table 1)	Parke <i>et al.</i> , 2002
<i>Viburnum X bodnantense</i>	viburnum	Ericaceae	North American & European isolates tested, no distinction in results reported - young plants inoculated through stem or leaf tissue were free of apparent damage	de Gruyter <i>et al.</i> , 2002
<i>Viburnum davidii</i>	viburnum	Ericaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be slightly susceptible	UK PRA, 2003

Latin Name	Common Name(s)	Plant Family	Comments	Reference
<i>Viburnum davidii</i>	viburnum	Ericaceae	mating type and origin of isolate(s) not stated, work conducted in North America - <i>V. davidii</i> susceptible in detached leaf assays to <i>P. ramorum</i> , but not to other <i>Phytothora</i> spp.	Linderman <i>et al.</i> , 2002
<i>Viburnum opulus</i>	guelder rose	Ericaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be resistant	UK PRA, 2003 Inman <i>et al.</i> , 2002
<i>Viburnum plicatum</i> var. <i>tomonentosum</i>	viburnum	Ericaceae	mating type and origin of isolate(s) not stated, work conducted in North America - <i>V. davidii</i> susceptible in detached leaf assays to <i>P. ramorum</i> , but not to other <i>Phytothora</i> spp.	Linderman <i>et al.</i> , 2002
<i>Viburnum tinus</i>	viburnum laurustinus	Caprifoliaceae	North American isolates, detached leaf assay results indicate high susceptibility	Parke <i>et al.</i> , 2002
<i>Viburnum tinus</i>	viburnum laurustinus	Caprifoliaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be moderately susceptible	UK PRA, 2003
<i>Viburnum</i>	viburnum	Caprifoliaceae	North American & European isolates tested; no significant differences; potentially moderately susceptible spp. in genus	Inman <i>et al.</i> , 2002
<i>Vitis vinifera</i>	grapevine	Vitaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003
<i>Weigela japonica</i>	Japanese weigela	Caprifoliaceae	North American & European isolates tested, no distinction in results reported - leaf inoculation studies indicate potential to be virtually immune	UK PRA, 2003
<i>Zenobia pulverulenta</i>	dusty zenobia	Ericaceae	Californian isolate 0-217 & type culture 9/95 (European), detached leaf assays resulted in mean lesion area of 32.6% total leaf surface	Tooley & Englander, 2002

GEOGRAPHICAL DISTRIBUTION

Europe:

Belgium (De Merlier *et al.*, 2003; Heungens *et al.*, 2003)

confirmed on *Rhododendron yakusimanum* and *Viburnum bodnatense* in nurseries

Denmark (Hendrickson *IN* UK PRA, 2003)

France (Delatour *et al.*, 2002; Husson *et al.*, 2003)

present on *Rhododendron* spp. and *Virburnum* spp. in nurseries

Germany (Werres, 2001)

present on *Rhododendron* & *Viburnum* in nurseries and private gardens (EPPO Reporting Service No. 5, May 2002)

The Netherlands (UK PRA, 2003)

present on *Rhododendron ponticum*, *R. 'Catawbiense'*, and *Viburnum X bodnatense* 'Dawn' in

nurseries, public greens and private gardens (draft NL survey report, 2001; NL PRA, October 2002)

Poland (Orlikowski & Szkuta, 2002)
detected on imported *Vaccinium vitis-idaea*

Spain (Mallorca, Balearic Islands) (Moralejo & Descals, 2003)
present on *Rhododendron* in nurseries in two towns in Mallorca

Sweden (UK PRA, 2003)

United Kingdom - England, Scotland, Wales, Channel Islands (DEFRA, 2003)
present on *Rhododendron*, *Viburnum*, *Pieris*, *Camellia* & *Kalmia* in England, Scotland, Wales & Channel Islands; confirmed on ornamentals in over 150 nurseries (DEFRA, May 2003)

North America:

United States -

California - Confirmed in twelve counties, namely Alameda, Contra Costa, Humboldt, Marin, Mendocino, Monterey, Napa, San Mateo, Santa Clara, Santa Cruz, Solano and Sonoma; detected in nurseries in four California counties, namely Stanislaus, Alameda, Santa Cruz and Marin Counties on *Viburnum tinus*, *Camellia japonica*, *C. sasanqua* and rhododendron nursery stock (COMTF June 2003)

In addition, *P. ramorum* was detected by PCR analysis in hosts in Placer County in the foothills of the Sierras in California in the fall of 2001, but the organism could not be isolated from plant tissues and no symptoms were evident (UK PRA, 2003); leaf spot symptoms were evident on bay, toyon and other species but *P. ramorum* could not be confirmed to be present.

Oregon - Confirmed in Curry County, nine positive sites totalling 39.6 acres distributed over an area of approximately 8.5 square miles area near Brookings (Osterbauer², personal communication)

The pathogen has been detected in an isolated incident in containerized stock (*Pieris*, *Rhododendron* & *Viburnum*) in a nursery in Clackamas County (ODA, 2003). Mating studies and microsatellite DNA analysis indicate that infection is of the A1 mating type (ODA, 2003).

Washington - Confirmed on containerized stock (*Rhododendron*) in a nursery in King County (Washington State Department of Agriculture News Release, June 5, 2003)

Canada-

British Columbia - confirmed on containerized nursery stock (*Rhododendron*) in a nursery (CFIA News Release, June 13, 2003)

A national survey for *Phytophthora ramorum* was conducted in Canada in the spring and summer of 2002. Close to 3000 samples from five provinces (NB, NS, QC, ON and BC) were submitted with no *Phytophthora ramorum* found (CFIA, 2003). Survey results will be posted to <http://www.inspection.gc.ca/english/sci/surv/situe.shtml> when all data have been incorporated. A similar survey is planned for 2003.

²

Nancy K. Osterbauer, Plant Division, Oregon Department of Agriculture, 635 Capitol St. NE Salem, Oregon 97301-2532. 31 October 2001 by email to L. Cree, CFIA.

Mating Types in *Phytophthora ramorum*

Twenty-two European isolates of *P. ramorum*, collected from various hosts were very homogenous; they showed only small variations in colony morphology, growth rate, size and shape of sporangia and chlamydospores (Zielke & Werres, 2002). Ten American isolates collected from various hosts, however, showed considerable variability; some were morphologically identical to the European isolates but others developed quite different colony patterns and grew very slowly (Zielke & Werres, 2002). In comparative studies of American and European isolates conducted in the UK, North American isolates were slower growing at 20EC than were their European counterparts and were also more phenotypically variable (Brasier *et al.*, 2002). Sporangia produced by some of the American isolates were distinctly different in shape from those produced by European isolates (Zielke & Werres, 2002).

All European isolates belonged to the A1 mating type. Most North American isolates belonged to the A2 mating type, but two isolates did not produce oogonia with any of the partners used in the assay and could not be typed (Zielke & Werres, 2002). *In vitro* pairing experiments with the type strain of *P. ramorum* (BBA 9/95) with the ten American isolates used in this study were unsuccessful; oogonia were not produced after eight weeks' incubation on either carrot piece agar or rhododendron agar. In ongoing screening tests conducted in the UK, 32 isolates from California and Oregon were shown to be of the A2 mating type, whereas 33 isolates from across Europe were all A1 mating type (Brasier, 2003). Isolates collected from an Oregon nursery in the spring of 2003 were shown to be A1 mating type based on mating studies and microsatellite DNA analysis (<http://oda.state.or.us/plant/ppd/path/sod/030624SODrpt.pdf>).

In mating pair tests, *P. ramorum* isolates rarely if ever mate together, so it is not clear if the species has a normally functioning A1 X A2 outcrossing system, as has been observed in other *Phytophthora* species (Brasier, 2003). Production of gametangia may be observed when *P. ramorum* isolates are grown in culture in test pairings with A1 or A2 types of other *Phytophthora* species (Brasier, 2003). *In vivo* and *in vitro* mating studies of *P. ramorum* were conducted by pairing *P. ramorum* isolates with A1 and A2 mating types of four other *Phytophthora* species, namely *P. cambivora*, *P. cinnamomi*, *P. cryptogea* and *P. dreschleri* (Werres and Zielke, 2003). All European isolates tested were shown to belong to the A1 mating type, producing oospores on carrot piece agar when paired with A2 mating type *P. cryptogea*; pairing with other *Phytophthora* species produced variable results. Eight of the 10 American isolates studied were demonstrated to be of the A2 mating type; seven isolates successfully produced oospores when paired with mating type A1 of *P. cryptogea*, six were successful in combination with *P. cambivora* and two with *P. dreschleri* (Werres and Zielke, 2003). In all cases, the number of oospores produced was low and most were degenerate. Two American isolates did not produce oospores under any circumstance tested and could not be typed. Significantly, Werres and Zielke (2003) were able to demonstrate the successful *in vitro* pairing of American isolate PR6 with European isolate BBA 9/95 in which oospores were produced in inoculated *Rhododendron* cv. 'Cunningham's White' twigs.

To date, it appears that there is no significant difference in the degree of *in vitro* pathogenicity between the American A2 mating type and the European A1 mating type (Brasier *et al.*, 2002, de Gruyter *et al.*, 2002; Tooley & Englander, 2002). Initial studies of the aggressiveness of European and American isolates to rhododendron, however, identify some differences. All European isolates tested caused a twig dieback and disease development was identical for all isolates, whereas the virulence of the ten American isolates tested was highly variable (Pogoda & Werres, 2002). Some isolates caused a twig dieback identical to that caused by European isolates, whereas other isolates caused only moderate dieback and others caused no discolouration at all on inoculated rhododendron twigs. These are preliminary results, however, and it has yet to be determined whether these variations are due to degeneration of some of the American isolates or if it is due to true genetic variation within the American population of *P. ramorum* (Pogoda & Werres, 2002).

In inoculation studies of woodland species in the UK, using American and European isolates of *P. ramorum*, there were few differences between isolates in their ornamental and non-tree host range and pathogenicity, although there were some differences in aggressiveness (Brasier *et al.*, 2002; Inman *et al.*, 2002). In a direct comparison, 15 European isolates were more aggressive than 15 North American isolates in bark inoculations of *Quercus rubra* and *Q. robur*, although there was a large overlap in the ranges of lesion length observed for each (Brasier *et al.*, 2002).

REFERENCES

- Brasier, C.M., J. Rose, S.A. Kirk and J.F. Webber, 2002. Pathogenicity of *Phytophthora ramorum* isolates from North America and Europe to bark of European Fagaceae, American *Quercus rubra* and other forest trees. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/paper/paper09.html> [United Kingdom]
- Brasier, C., 2003. Sudden Oak Death: *Phytophthora ramorum* exhibits transatlantic differences. Mycological Research 107: 258 - 259.
- Brasier, C.M., J. Rose, S. Kirk and J. Webber, 2003. Pathogenicity of *Phytophthora ramorum* isolates from USA and Europe to bark of European forest trees. 8th International Congress of Plant Pathology (ICPP2003), Christchurch, New Zealand. February 5 - 7, 2003. Abstract 11.23.
- CFIA, 2003. Summary of Plant Quarantine Pest and Disease Situations in Canada - 2002. Unpublished. Canadian Food Inspection Agency, Plant Pest Surveillance, Plant Health Risk Assessment Unit, Science Division.
- COMTF. California Oak Mortality Task Force Monthly Reports. <http://www.suddenoakdeath.org/>
- DEFRA, 2003. Department for Environment, Food and Rural Affairs of the United Kingdom. Plant Health. <http://www.defra.gov.uk/plant/oak.htm> 2003/06/11.
- de Gruyter, H., R. Baayen, J. Meffert, P. Bonants & F. van Kuik, 2002. Comparison of pathogenicity of *Phytophthora ramorum* isolates from Europe and California. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/paper/paper10.html> [Netherlands]
- Delatour, C., C. Saurat, C. Husson, R. Ios and N. Schenck, 2002. Discovery of *Phytophthora ramorum* on *Rhododendron* sp. in France and experimental symptoms on *Quercus robur*. Poster Abstract. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/poster/poster57.html> [France]
- De Merlier, D., A. Chandelier and M. Cavelier, 2003. First report of *Phytophthora ramorum* on *Viburnum bodnantense* in Belgium. Plant Disease 87: 203. [Belgium]
- Garbelotto, M., J.M. Davidson, K. Ivors, P.E. Maloney, D. Huberli, S.T. Koike and D.M. Rizzo, 2003. Non-oak native plants are main hosts for sudden oak death pathogen in California. California Agriculture 57: 18 - 23. [United States]
- Goheen, E., E. Hansen, A. Kanaskie, M. McWilliams, N. Osterbauer and W. Sutton, 2002. Sudden oak death caused by *Phytophthora ramorum* in Oregon. Plant Disease 86: 441. [United States]
- Goheen, E., E. Hansen, A. Kanaskie, M. McWilliams, N. Osterbauer and W. Sutton, 2002. Plant species naturally infected by *Phytophthora ramorum* in Oregon forests. Poster Abstract. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/poster/poster5.html>
- Hansen, E. and W. Sutton, 2002. Log inoculations to assess tree susceptibility to sudden oak death. Phytopathology 92 (Supplement): S33. [United States]
- Hüberli, D., W. Van Sant-Glass, J.G. Tse and M. Garbelotto, 2003. First report of foliar infection of starflower by *Phytophthora ramorum*. Plant Disease 87: 599. [United States]
- Inman, A.J., P.A. Beales, C.R. Lane and C. Brasier, 2002. Comparative pathogenicity of European and American isolates of *Phytophthora ramorum* to leaves of ornamental, hedgerow and woodland under-story plants in the UK. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/poster/poster49.html> [United Kingdom]
- Lane, C.R., P.A. Beales, K.J.D. Hughes, R.L. Griffin, D. Munro, C.M. Brasier and J.F. Webber, 2002. First outbreak of *Phytophthora ramorum* in England, on *Viburnum tinus*. New Disease Reports Vol. 6: August 2002 - January 2003. <http://www.bspp.org.uk/ndr/jan2003/2002-39.asp> [United Kingdom]

- Orlikowski, L.B. and G. Szkuta, 2002. *Phytophthora ramorum* sp. nov., a new species in Poland recovered from *Rhododendron*. *Phytopathologica Polonica* 25: 69 - 79. [Poland]
- Moralejo, E. & E. Descals, 2003. Risk analysis of *Phytophthora ramorum* establishment in the Mediterranean area. Sudden Oak Death. How Concerned Should You Be? An International Symposium · April 21 - May 12, 2003, hosted by The American Phytopathological Society. <http://sod.apsnet.org/>. [Spain]
- Moralejo, E. & L. Hernández, 2002. Inoculation trials of *Phytophthora ramorum* on detached Mediterranean sclerophyll leaves. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/paper/paper25.html>
- Moralejo, E. & S. Werres, 2002. First report of *Phytophthora ramorum* on *Rhododendron* sp. in Spain. *Plant Disease* 86: 1052.
- Murphy, S.K. and D.M. Rizzo, 2002. A Survey of Sudden Oak Death in Native California Forest and Woodland Communities: Relating Incidence and Intensity of *Phytophthora ramorum* to Plant community and Site Variables. Poster Abstract. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/poster/poster19.html> [United States]
- ODA, 2003. ODA Final Report on *Phytophthora ramorum* in Clackamas County, Oregon. Oregon Department of Agriculture <http://oda.state.or.us/plant/ppd/path/SOD/030624SODrpt.pdf>
- Parke, J.L., R.G. Linderman and E.M. Hansen, 2002. Assessing the susceptibility of Pacific Northwest nursery plants to *Phytophthora ramorum* using a detached leaf assay. Poster Abstract. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/poster/poster53.html> [United States]
- Parke, J.L., R.G. Linderman and E.M. Hansen, 2002b. Susceptibility of *Vaccinium* to *Phytophthora ramorum*, cause of sudden oak death. *Phytopathology* 92: S63.
- Pogoda, F. and S. Werres, 2002. Pathogenicity of European and American *P. ramorum* isolates to rhododendron. Poster Abstract. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/poster/poster26.html> [Germany]
- Rizzo, D.M., 2003. Sudden Oak Death: Host plants in forest ecosystems in California and Oregon. Sudden Oak Death. How Concerned Should You Be? An International Symposium · April 21 - May 12, 2003, hosted by The American Phytopathological Society. <http://sod.apsnet.org/>. [United States]
- Rizzo, D.M., M. Garbelotto, J.M. Davidson, G.W. Slaughter & S.T. Koike, 2002. *Phytophthora ramorum* as the cause of extensive mortality of *Quercus* spp. and *Lithocarpus densiflorus* in California. *Plant Disease* 85: 205 - 214.
- Tjosvold, S.A., S.T. Koike, J.M. Davidson & D.M. Rizzo, 2002. Susceptibility of azalea (*Rhododendron*) to *Phytophthora ramorum*. Poster Abstract. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/poster/poster45.html> [United States]
- Tooley, P.W. and L. Englander, 2002. Infectivity of *Phytophthora ramorum* on selected Ericaceous host species. *Phytopathology* 92: S81. [United States]
- UK DEFRA, 2003. *Phytophthora ramorum* Sudden Oak Death. United Kingdom Department for Environment Food and Rural Affairs <http://www.defra.gov.uk/plant/oak.htm>
- UK PRA, 2003. Pest Risk Analysis, Sudden Oak Death. Revision number 3, 20 March 2003. <http://www.defra.gov.uk/plant/prasudd.pdf>
- Werres, S., R. Marwitz, W.A. Man In'T Veld, A. De Cock, P. Bonants, M. De Weerd, K. Themann, E. Liieva and R.P. Baayen, 2001. *Phytophthora ramorum* sp. nov., a new pathogen on *Rhododendron* and *Viburnum*. *Mycological Research* 105: 1155 - 1164. [Germany]
- Werres, S. and B. Zielke, 2003. First studies on the pairing of *Phytophthora ramorum*. *Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz* 110: 129 - 130.
- Zielke, B. & S. Werres, 2002. Taxonomic investigations of European and American isolates of *Phytophthora ramorum*. Poster Abstract. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/poster/poster27.html> [Germany]
- Zanzot, J.W., J.L. Parke and E.M. Hansen, 2002. Susceptibility of Oregon's tanoak-associated plant species to *Phytophthora ramorum*. Presentation Abstract. Sudden Oak Death Science Symposium, December 15 - 18, 2002, Monterey, California. <http://danr.ucop.edu/ihrmp/sodsymp/paper/paper34.html>. [United States]