

The current status of *Phytophthora ramorum* in Austria

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ABSTRACT

Since the middle of the 90ies of the last century symptoms of wilting in plants of *Rhododendron* and *Viburnum* were quite often observed in tree nurseries of Germany and the Netherlands. At approximately the same time a new fatal phenomenon in several oak species, named Sudden Oak Death, was recorded in the USA. In 2001 this new pathogen was described as *Phytophthora ramorum* Werres et al. Since 2002 a monitoring is carried out in the member states of the European Union. At first this new *Phytophthora* species was found mainly on plants of *Rhododendron* (except *R. simsii*) and *Viburnum*, but now there a lot of shrubs are found to be infected like *Pieris formosa* var. *forrestii*, *P. japonica*, *Kalmia latifolia*, *Camellia japonica*, *Syringa vulgaris*, *Leucothoë* sp., *Taxus baccata*, *Hamameils virginiana* and *Arbutus* sp. In 2004 even trees such as *Quercus cerris*, *Q. ilex*, *Q. falcata*, *Aesculus hippocstanum*, *Fagus sylvatica* and *Castanea sativa* were infected.

In the 2004 monitoring program 447 visual controls in tree nurseries, garden centres and in the public green were carried out in Austria. In all federal state samples were taken from forests and windbreaks, in which susceptible trees like *Fagus sylvatica*, *Aesculus hippocstanum*, *Quercus cerris*, *Quercus petraea*, *Quercus robur*, *Quercus rubra*, *Castanea sativa*, *Pseudotsuga menziesii* or *Taxus baccata* occur. None of the examined plants was infected by *Phytophthora ramorum*.

INTRODUCTION

Since the middle of the 90ies of the last century symptoms of wilting in plants of *Rhododendron* and *Viburnum* were quite often observed in tree nurseries of Germany and the Netherlands. At approximately the same time a new fatal phenomenon in several oak species, named Sudden Oak Death, was recorded in the USA. Neither the pathogen which was found in the tree nurseries causing wilts nor the one which caused Sudden Oak Death in the USA was known at this time. In 2001 a new *Phytophthora* species, described as *Phytophthora ramorum* Werres et al. was identified as the causal agent. A short time later it was clear, that this pathogen also was responsible for the dying of the oak trees in the USA.

Phytophthora ramorum belongs to kingdom Chromista and is classified as an oomycetes (water mould). Similar to other water moulds, *Phytophthora ramorum* requires a moist environment for active growth and reproduction. The spores of the fungus are found on leaf surfaces of the susceptible plants. Windblown rain and contaminated soil serve in transmission of the fungus from one plant to another. As *Ph. ramorum* belongs to the

heterothallic *Phytophthora* species, different mating types occur. Early analyses showed that initially only mating type A1 was found in Europe and only mating-type A2 in the USA. In the meantime both mating types could be detected both in Europe and in the United States. The geographical origin of *P. ramorum* is still unknown, but it is possible that it may have originated somewhere in Asia, more specifically, in northern Yunnan Province in the People's Republic of China, because rhododendrons and azaleas are abundant there, and the climatic conditions in this part of the province correlate well with those predicted to be favorable for *P. ramorum*.

The occurrence of *Phytophthora ramorum* in Europe

Since the beginning of the monitoring programs carried out in the member states of the European Union, this pathogen could be detected in more and more countries and even on more and more different plants. Germany, the Netherlands and the United Kingdom were the first countries which notified the occurrence of this pathogen. In the meantime this pathogen was found in Belgium, Denmark, France, Ireland, Norway, Switzerland and Spain. During the first years mainly *Viburnum*- and *Rhododendron*-species (except *R. simsii*) were infested, but since 2003 shrubs like *Pieris formosa* var. *forrestii*, *P. japonica*, *Kalmia latifolia*, *Camellia japonica*, *Syringa vulgaris*, *Leucothoë* sp., *Taxus baccata*, *Hamameils virginiana* and *Arbutus* sp. came up with this disease. In 2004 this pathogen was isolated even from trees such as *Quercus cerris*, *Quercus petraea*, *Quercus robur*, *Quercus rubra*, *Aesculus hippocastanum*, *Fagus sylvatica* and *Castanea sativa*. Now there are no longer significant differences between host plant ranges in Europe and the USA (*Acer macrophyllum*, *Aesculus californica*, *Arbutus menziesii*, *Arctostaphylos manzanita*, *Camellia* sp., *Hamamelis virginiana*, *Heteromeles arbutifolia*, *Lithocarpus densiflorus*, *Lonicera hispidula*, *Pieris* sp., *Pseudotsuga menziesii*, *Quercus agrifolia*, *Quercus chrysolepis*, *Quercus kelloggii*, *Quercus parvula* var. *shrevei*, *Rhamnus californica*, *Rhododendron* sp., *Rosa gymnocarpa*, *Sequoia sempervirens*, *Umbellularia californica*, *Trientalis latifolia*, *Vaccinium ovatum* and *Viburnum* sp.).

Besides the increase in number of natural hosts, there is also another development that gives cause for concern. The first discoveries of this new disease always occurred in tree nurseries, but now this pathogen is found in public green, in private gardens and in the natural environment, especially in the UK, the Netherlands and Germany. In these countries high humidity and moderate temperatures give excellent conditions for survival and spread of this pathogen.

The occurrence of *Phytophthora ramorum* in the USA

Since 1995 *Phytophthora ramorum* is found mainly in the central coastal areas of the Californian counties of Alameda, Contra Costa, Humboldt, Los Angeles, Marin, Mendocino, Monterey, Napa, San Mateo, Santa Clara, Santa Cruz, Solano and Sonoma as well as in Oregon (County of Curry). In these areas a serious fatality of trees, especially oaks and tanoaks such as *Quercus agrifolia*, *Quercus kelloggii* or *Lithocarpus densiflorus* are observed. But many other plant species can become infected, and they help spread the disease. One of the most important plants in this case is the Californian bay laurel

(*Umbellularia californica*). In the meantime *Phytophthora ramorum* has also been found in Florida, Georgia and Washington.

The current situation in Austria

Up to this date there has been no record of *Phytophthora ramorum* in Austria. One of the most important reasons might be the climate. In Austria warm and dry summers and cold winters predominate. Thus, climatic conditions do not correlate well with those predicted to be favorable for *P. ramorum*. An aggravating factor is that in most parts of Austria the conditions are not suitable for growing plants such as *Rhododendron*, *Camellia* or *Pieris*. Growing these shrubs is usually very difficult, and in spite of all efforts plants often die of black frost, lack of water or too high lime content in the soil. At the moment the occurrence and establishment of this pathogen could be expected surrounding areas of Lake Constance (Vorarlberg) because of its mild and humid climate. Among plant species favored for horticultural purposes, species of *Viburnum*, *Syringae* and/or *Taxus* would be the most likely to become infected by *Phytophthora ramorum*. In forests plants like *Fagus sylvatica*, *Aesculus hippocastanum*, *Quercus cerris*, *Quercus petraea*, *Quercus robur*, *Quercus rubra*, *Castanea sativa*, *Pseudotsuga menziesii* or several species of *Vaccinium* are known as susceptible. If the pathogen eventually adapts to dryer climatic conditions and establishes itself in Austrian forests, severe damage may occur.

In 2004 447 visual controls were carried out in tree nurseries, garden centres and in the public green in Austria. 106 inspections were conducted in tree nurseries and 341 in public green or private gardens. 36 plants from tree nurseries and 6 plants from public greens showed *Phytophthora*-like symptoms and were tested in the laboratory (isolation, PCR) for *Phytophthora ramorum*. No sample was tested *Phytophthora ramorum* positive. Most of the damage on *Rhododendron* and *Viburnum* was caused by non-parasitic agents or pathogens like *Pestalotiopsis guepini*, *Botrytis cinerea* or *Phyllosticta*-species. *Phytophthora citricola* was isolated from two of the *Rhododendron* samples.

To check possible immigration of *Phytophthora ramorum* in Austria samples were also taken from forests and windbreaks in each federal state in which susceptible trees such as *Fagus sylvatica*, *Aesculus hippocastanum*, *Quercus cerris*, *Quercus petraea*, *Quercus robur*, *Quercus rubra*, *Castanea sativa*, *Pseudotsuga menziesii* or *Taxus baccata* occur. These areas were examined visually for typical symptoms of infection with *P. ramorum*, e. g. wilted shoots, pale green to dark brown leaves or parts of leaves, burgundy-red to black sap oozing (bleeding) on the bark surface or flattened cankers. Other species of trees were examined when they showed typical symptoms of an infection with *Phytophthora*. During the entire 2004 season the following plant numbers were inspected:

<i>Aesculus hippocastanum</i>	252	<i>Quercus cerris</i>	153
<i>Castanea sativa</i>	163	<i>Quercus petraea</i>	441
<i>Douglasia</i>	30	<i>Quercus robur</i>	579
<i>Fagus sylvatica</i>	868	<i>Quercus rubra</i>	45
<i>Fraxinus excelsior</i>	205	<i>Taxus baccata</i>	34
<i>Morus alba</i>	5	<i>Vaccinium corymbosum</i>	20
<i>Populus tremula</i>	1	<i>Viburnum</i> sp.	403

Laboratory analysis was conducted on a total of 38 samples: *Aesculus hippocastanum* (2), *Castanea sativa* (2), *Fagus sylvatica* (13), *Morus alba* (1), *Populus tremula* (1), *Quercus petraea* (2), *Quercus robur* (4), *Quercus cerris* (1), *Quercus rubra* (2), *Taxus baccata* (3), *Vaccinium corymbosum* (3) and *Viburnum* sp. (4). All examined plants were *Phytophthora ramorum* negative. In some cases infections with various *Phytophthora* species were detected, but all of these species are common in Austria.

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