

Effect of Environmental and Seasonal Factors on the Susceptibility of Different *Rhododendron* Species and Hybrids to *Phytophthora ramorum*¹

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Abstract

Although *Rhododendron* is the most important host of *Phytophthora ramorum* in Europe, there is little scientific information about the susceptibility levels of different *Rhododendron* species and cultivars. Increasing this knowledge would help nurseries in the management of the disease and could be used by plant protection services to target their inspections. In this study a total of 80 *Rhododendron* species and hybrids were screened for their susceptibility to *P. ramorum* using two detached leaf inoculation assays. Due to the variability in susceptibility for a given cultivar within and between years, multi-year data was deemed necessary to establish a reliable susceptibility ranking. The zoospore inoculation method involving non-wounded leaves was most informative. Using this method, a wide range in susceptibility to *P. ramorum* was demonstrated. A second objective of this study was to get a better handle on some of the internal and external factors (time of year, temperature, leaf age) that seem to effect the susceptibility level. Susceptibility was significantly lower during late fall and winter, and seems correlated with the physiological status of the plant. Leaf age mainly seems to affect susceptibility during the early stages of leaf maturity. In general, new leaves were more susceptible to pathogen development. However, young leaves of some cultivars seem covered by leaf hairs, which prevent the zoospores to reach the leaf surface. Environmental factors that affect stomatal regulation, such as temperature, also seemed to have an effect on the degree of symptom development.

Key words: *Phytophthora ramorum*, *Rhododendron*, susceptibility, host resistance, cultivars.

Introduction

Since November 2002, EU emergency phytosanitary measures are being taken to prevent the introduction and spread of *P. ramorum* in Europe, including surveys at all commercial premises with *P. ramorum* hosts. An eradication and quarantine program is initiated at nurseries with positive findings. Commercial *Rhododendron* plants are the most important hosts of *Phytophthora ramorum* in Europe. In Belgium, one of the largest *Rhododendron*-producing countries of Europe, about 80 percent of the samples in the *P. ramorum* surveys of the plant protection service were *Rhododendron* plants. Because of the quarantine status of *P. ramorum*, only preventive measures can be taken by the growers. These measures mainly consist of

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water management, sanitation, hygiene and preventive fungicide treatments. Taking into account cultivar susceptibility would be another tool for which there is high interest, but limited availability of scientific knowledge. This information could lead to using more resistant cultivars and to extra protection of susceptible cultivars. In the long term, including resistance to *P. ramorum* may become a part of *Rhododendron* breeding efforts.

Materials and Methods

This study was initiated during the summer and early fall of 2004 with a screening of 63 *Rhododendron* species and hybrids. *Rhododendron* species were selected to represent the main subdivisions within the genus *Rhododendron*. Hybrids were selected based on their economic importance. Preliminary assays revealed no differences in pathogenicity between different *P. ramorum* isolates, hence a single Belgian isolate was used in all assays. Initially, four inoculations methods were used, involving either wounded or non-wounded detached leaves or stems. Based on the variability in susceptibility of the control cultivar over the testing period, it was concluded that multi-year data was needed to establish a reliable susceptibility ranking. Therefore, the assays were repeated in 2005 and 2006. The tests were extended to 80 *Rhododendron* hosts (24 species and 56 hybrids) but only the two most informative inoculation assays were used. A method involving non-wounded leaves and zoospore inoculation was used to estimate the ability of the host to resist tissue penetration. A method involving wounded leaves was used to evaluate the resistance to pathogen growth inside leaf tissue. Each year the *Rhododendron* plants were screened from July to September. Leaves were mature but less than one year old. The assays were performed in batches and included the same three control cultivars in each batch (*Rhododendron* Mme Masson, *R. Cunningham's White*, and *R. Gartendirector Rieger*). Seasonal effects were studied in an experiment in which leaves of *R. Cunningham's White* were collected and inoculated on a bi-weekly basis over a period of two years. During the spring, both new leaves and mature leaves of several cultivars were inoculated and compared in respect to susceptibility to *P. ramorum*. In tests involving the effect of temperature, potted plants were placed in growth chambers at 5, 17 or 28°C during several hours, after which they were used in the inoculation assay involving non-wounded leaves.

Results and Conclusions

All the *Rhododendron* species and cultivars tested were susceptible to *P. ramorum* in the method involving wounded leaves. In contrast, the method with non-wounded leaves revealed a considerable difference in level of resistance between cultivars or species. Using this method, a few *Rhododendron* species and cultivars consistently showed very low levels of disease expression. These included *R. Gartendirector Rieger*, *R. Red Jack*, and *R. Fantastica*. In contrast, some cultivars such as *R. Mme Masson*, *R. John Walter*, and *R. Cheer* were highly susceptible and may be candidates for improved *P. ramorum* leaf baiting methods. The average level of susceptibility during the screening assays was significantly different between the years but was not caused by a decrease in virulence of the test isolate. No correlation was observed between the susceptibility level and the genetic background of the hybrids. However, the genetic background of the *Rhododendron* hybrids is often mixed or unclear.

Within the *Rhododendron* species, lepidote species on average were less susceptible than elepidote species.

In terms of seasonal effects, susceptibility was significantly lower during late fall and winter, and seems correlated with the physiological status of the plant. Leaf age plays an important role in susceptibility tests. When using wounded leaves, young leaves of all cultivars tested showed a higher level of susceptibility than mature leaves. However, when using non-wounded leaves, young leaves of some cultivars were less susceptible than older leaves. This effect was correlated with the presence of hairs on the young leaves of those cultivars, which probably form a barrier to the zoospores and prevent tissue penetration by the pathogen. Exposing plants to high temperatures during several hours before collection of the leaves had a negative effect on susceptibility in most experiments. One hypothesis is that this increase in temperature results in stomatal closure, which may reduce the penetration capacity of the pathogen.

Literature Cited

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