Managing *Phytophthora ramorum* in the Netherlands[1]

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Phytophthora ramorum came to the Netherlands in 1993. Despite initially not seeming to pose a high risk, findings in California showed its potential destructive impact on ecosystems. A programme began in the Netherlands to eliminate *P. ramorum* from nurseries and surveys in the natural environment were held to obtain information to determine a strategy for dealing with the disease. About 1100 nurseries are inspected annually by NAKtuinbouw under the auspices of the Plant Protection Service and measures are taken according to EC directives. The percentage of infected nurseries decreased steadily during recent years, from 4% in 2002/2003 to 0.5% in 2004/2005. Surveys in the natural environment show that *P. ramorum* occurs on 2% of the sites with *Rhododendron* and therefore it was concluded that an elimination scenario is not realistic. A programme based on containment measures supported by an extension programme was put into place with its effects being monitored by the Plant Protection Service. 12 years of observing *P. ramorum* show that the risk for indigenous trees and shrubs in the Netherlands is very limited. Spread from infected rhododendrons to other potential hosts, even at heavily infected *Rhododendron* sites, hardly takes place although some infected *Quercus rubra* trees have been found. Recently several new *Phytophthora* species were found in natural environments in Europe and California, mainly as a result of intensive *P. ramorum* surveys. As well as *P. ramorum*, the *Phytophthora* spp. *P. kernoviae*, *P. numerosa* and *P. pseudosyringae* pose risks, indicating the need for a more general approach against *Phytophthora* diseases. As a result, a new protocol for detection and identification of *Phytophthora* spp. both as a group and individually is being developed and workers are asking whether these *Phytophthora* species could be managed together.

Introduction

Phytophthora ramorum has been present in the Netherlands since 1993. For several years, there was no indication that this new *Phytophthora* species, found on *Rhododendron* and *Viburnum*, posed a risk. Experiences in California, however, showed its potential destructive impact on ecosystems. This encouraged a small survey in the Netherlands to be carried out in 2001, in order to find out its distribution. The current management approach is based on the results of these inspections, research work, European commission decisions, and intensive discussions with stakeholders and policymakers. The main aims of this approach are to protect indigenous plants and preserve the landscape.

Nursery inspections

In the Netherlands there are around 1100 nurseries growing *Rhododendron*, *Viburnum* or *Camellia*. The NAKtuinbouw, the Netherlands Inspection Service for Horticulture, inspects these nurseries. All host plants are inspected for *Phytophthora ramorum*, with *Rhododendron*, *Viburnum* and *Camellia* receiving the most intensive inspections. These inspections are performed under the supervision of the Plant Protection Service. Samples of symptomatic plants are sent to the Diagnostic Centre of the Plant Protection Service for diagnosis, with the Service managing the response to positive findings. Measures are taken according to the European Commission Decisions 2002/757/EC and 2004/426/EC, and an additional national measure bans the growing of host plants on an infected site for three years. Results of the nursery inspections from 2002/3 to 2005 are given in Table 1. There was a decrease in the number of findings from 4% in 2002/2003 to 1% in 2004/2005. During the inspection season 2002/2003, a high number of infected lots of

Table 1 Positive findings of *P. ramorum* on 1100 inspected nurseries, period 2002/5

Season	Number of nurseries with confirmed infections	% of nurseries with confirmed infections	Lots (*Viburnum*, *Rhododendron*)
2002/2003	43	4	49
2003/2004	14	1.5	15*
2004/2005	8	0.8	12
2005**	2	2	2

*One lot *Taxus* (x) *media*.

**1st of July to 30th of September.

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Viburnum (×) *bodnantense* 'Dawn' (32) was found. The number of infections decreased sharply in parallel with the reduction in the production of *Viburnum* (×) *bodnantense*. From the results it can be concluded that the control measures were effective. Nevertheless, the Plant Protection Service still receives new notifications, indicating that infections may have been overlooked, or are latently present. Research may be needed to ascertain the consequences for infection by *P. ramorum* of spraying and irrigation.

Non-nursery sites

A large survey was executed in 2003 in non-nursery sites in which host plants grew, based on the Commission Decision 2002/757/EC. The primary aim was to learn more about the spread of the disease. 1380 sites with *Rhododendron* were inspected to obtain information about occurrence and distribution of *P. ramorum*. An additional 98 sites with *Vaccinium myrtillus* were inspected. In this survey 2% of the inspected *Rhododendron* sites proved to be infected with *P. ramorum*. Many sites were heavily infected. The infected sites were mainly concentrated in the eastern central part of the Netherlands. No infections were found on *Vaccinium myrtillus*. The conclusion was drawn that complete eradication from the territory of the Netherlands was not feasible and that the larger severely infected sites posed the highest risk for indigenous plants. In succeeding years, the survey aimed to measure the risk of *P. ramorum* for indigenous plants and to obtain more information about favourable conditions for infection. The survey in 2005 was therefore concentrated on other potential host plants, which were located near infected *Rhododendron* plants. Special attention was paid to oak and beech trees. In this survey two sites were found with infected *Quercus rubra* (Northern red oak). One site contained nine infected trees and the other site one. The risk for indigenous trees and shrubs seems limited in the Netherlands.

Research work was also done on effectiveness of treatments against *P. ramorum* and on its survival in soil and chipped infected plant material. Based on the surveys and research work done in the Netherlands and information from other countries an approach was developed on how to handle *P. ramorum* outside the nurseries. The approach is based on the policy that eradicating plants with *P. ramorum* is primarily the responsibility of the owner. Landowners themselves have to be keen to remove infections.

As a result, a programme based on containment measures, supported by an extension programme, was put in place.

Owners themselves are responsible for removing the plant completely or for cutting it back to a maximum of 30 cm above the soil surface. The infected plant material has to be burned, composted by tunnel composting, or buried at least 1 m deep. In practice, these measures proved to be very costly to owners. In general the landowners concerned want to cooperate, but the high costs to them of eradicating *P. ramorum* prevent them. To achieve a wider impact, a limited increase in risk is accepted by letting, on request of the owner, chipped infested plant material remain at the site.

The owners are given advice about removing infestations and dealing with infected plant material. If the owner doesn't remove the infestation they are prohibited from entering the infected area. After taking measures, the site is monitored by the Plant Protection Service for a period of 12 months. Replanting with nonhost plants is allowed. The prohibition from entering the area is lifted after the infestation has been removed.

In a field experiment and during follow-up inspections at the infested sites it became clear that after cutting back, new developing shoots may become infected directly from the infected stumps. In 50% of the infected sites, regrowth was found to be partly infected. Depending on the situation, infected shoots should be removed or the plants should be killed with glyphosates.

Phytophthora ramorum has been found in the soil as long as one year after removing the infected plants. In chipped infected wood infestation could still be found after one year.

A publicity campaign has been started to encourage owners to eradicate their infestations. This includes intensive communication and the development of management packages.

Developments

Managing public green spaces

Adequate management of public recreational areas will reduce the incidence of *Phytophthora* diseases considerably, therefore a more general approach for dealing with *Phytophthora* diseases outside nurseries is needed.

Detection methods

In recent years several new *Phytophthora* species have been found in the natural environment in Europe and California, mainly as a result of the intensive *P. ramorum* surveys. In cooperation with Plant Research International a combined risk analysis of *Phytophthora* species has been made. The aim is to study whether for management purposes species can be combined. *P. ramorum, P. numerosa, P. pseudosyringae* and *P. kernoviae* appear to be a cluster to consider. In this context a new PCR method for detection of *Phytophthora* at genus level combined with a multiplex Taqman PCR for detection of the mentioned *Phytophthora* species is in development.

La gestion de *Phytophthora ramorum* aux Pays-Bas

Phytophthora ramorum est arrivé aux Pays-Bas en 1993. Même si, au début, il ne semblait pas poser un risque important, des découvertes en California ont montré son impact de destruction potentiel sur les écosystèmes. Un programme a commencé aux Pays-Bas pour éliminer *P. ramorum* des pépinières et des prospections dans le milieu naturel ont été menées afin d'obtenir des informations pour déterminer une stratégie contre cet organisme. Environ 1100 pépinières sont inspectées annuellement par NAKtuinbouw sous les auspices du Service de la protection des végétaux et des mesures sont prises selon

les Directives de l'UE. Le pourcentage de pépinières infectées a décru régulièrement au cours des dernières années, de 4% en 2002/2003 à 0,5% en 2004/2005. Des prospections dans le milieu naturel montrent que *P. ramorum* est présent dans 2% des sites ayant des *Rhododendron* et, par conséquent, il est conclu que le scénario d'élimination n'est pas réaliste. Un programme basé sur des mesures d'enrayement soutenu par une campagne d'information a été mis en place, et ses effets sont suivis par le Service de la protection des végétaux. L'observation de *P. ramorum* pendant 12 ans a montré que le risque pour les arbres et les arbustes indigènes aux Pays-Bas est très limité. La dissémination à partir de rhododendrons infectés vers d'autres hôtes potentiels, même dans des sites avec des *Rhododendron* largement infectés, a rarement lieu même si quelques *Quercus rubra* infectés ont été trouvés.

Récemment plusieurs nouvelles espèces de *Phytophthora* ont été trouvées dans des milieux naturels en Europe et en California, principalement suite aux prospections intensives pour *P. ramorum*. Comme *P. ramorum*, les espèces de *Phytophthora P. kernoviae*, *P. numerosa* et *P. pseudosyringae* posent des risques, ce qui indique le besoin d'une approche plus générale contre les maladies à *Phytophthora*. En conséquence, un nouveau protocole pour la détection et l'identification des *Phytophthora* spp., aussi bien en tant que groupe qu'individuellement, est en cours de développement et on se demande si ces espèces de *Phytophthora* pourraient être gérées ensemble.

Управление *Phytophthora ramorum* в Нидерландах

Phytophthora ramorum присутствует в Нидерландах с 1993 г. Несмотря на то, что вначале она не представляла собой высокого риска, результаты, полученные в Калифорнии, показали ее потенциальное разрушающее воздействие на экосистемы. Поэтому в Нидерландах была предпринята программа ликвидации *P. ramorum* в питомниках и проведены обследования в естественной окружающей среде для того, чтобы собрать информацию и определить стратегию борьбы с этим вредным организмом. NAKtuinbouw под эгидой Службы защиты растений ежегодно обследует около 1100 питомников, а также предпринимаются меры в соответствии с директивами ЕС. За последние годы процент зараженных питомников стабильно сокращался, с 4% в 2002–2003 гг. до 0,5% в 2004–2005 гг. Обследования в естественной окружающей среде показывают, что *P. ramorum* встречается на 2% участков с рододендроном, поэтому был сделан вывод, что сценарий ликвидации является нереальным. Вместо него была введена в действие программа, основанная на мерах сдерживания, поддерживаемая кампанией по информированию производителей, причем ее действенность проверяется Службой защиты растений. 12 лет наблюдений за *P. ramorum* показывают, что риск для местных деревьев и кустарников в Нидерландах весьма ограничен. Распространение от зараженных рододендронов на другие потенциальные растения-хозяева, даже на участках сильно зараженных рододендронов, вряд ли имеет место, хотя и было найдено несколько зараженных деревьев *Quercus rubra*.

Недавно несколько новых видов *Phytophthora* были обнаружены в естественной окружающей среде в Европе и в Калифорнии, главным образом в результате интенсивных обследований *P. ramorum*. Так же как *P. ramorum*, *Phytophthora* spp., *P. kernoviae*, *P. numerosa* и *P. pseudosyringae* представляют собой риск, что указывает на необходимость более общего подхода к заболеваниям, вызываемым родом *Phytophthora*. В результате этого разрабатывается новый протокол для обнаружения и идентификации видов рода *Phytophthora*, как в качестве группы, так и индивидуально, поэтому производители задаются вопросом о целесообразности совместного управления этими видами *Phytophthora*.