

Hazelnut Bacterial Canker

Pseudomonas avellanae

Pest Risk Assessment

This risk assessment follows the format used by the Exotic Forest Pest Information System for North America. Guidelines are listed at www.exoticforestpests.org/english/guideleines/eval.htm.

IDENTITY

Name: *Pseudomonas avellanae* (Psallidas) Janse *et al.*

Taxonomic Position: Pseudomonadaceae

Common Name: Hazelnut Bacterial Canker

RISK RATING SUMMARY

Numerical Score: 10

Relative Risk Rating: HIGH

RISK RATING DETAILS

Establishment Potential Is: MEDIUM

Justification:

Significant commercial plantings of European hazelnut are limited to Oregon, Washington (state) and British Columbia. Ornamental plantings of hazelnuts are found throughout the United States but are not contiguous in nature. Wild and escaped trees are common throughout the Northwest Pacific region and essentially bridge all three commercial production areas. Susceptibility of native hazelnut species is unknown.

Economic Impact Potential Is: HIGH

Justification:

This pathogen is capable of killing commercial hazelnuts within a year or two post-infection. The wind-born nature of the pathogen and the high density planting of orchards and nursery stool beds in the western Pacific Northwest makes rapid spread extremely likely.

Environmental Impact Potential Is: MEDIUM**Justification:**

Escaped and native hazelnuts make up an major part of the riparian zone in the Pacific Northwest, providing food and habitat for many bird and mammalian species and serving as an important component in the region's watersheds. Loss of these species would reduce food and shelter choices for wildlife and lower biodiversity and effect watershed quality.

Degree of Uncertainty: MEDIUM

Uncertainty in this PRA results from the lack of information on the susceptibility of native *Corylus* species and the lack of research on effective chemical control agents and their use and delivery.

HOST(S)

Hazelnut bacterial canker attacks the European hazelnut (*Corylus avellana*) also known as the Filbert nut. Also, "wild" populations of hazelnuts are reported to be attacked in Italy, but their taxonomic identifications are uncertain. Experimental inoculations of the commercial cultivars 'Barcelona' and 'Royal' showed them to be susceptible to an Italian isolate, although the former cv. was judged to have field resistance to a northern Greek isolate of *P. avellanae*. 'Tonda di Giffonni', a promising eastern filbert blight tolerant pollinizer from Italy is also susceptible to *P. avellanae*. It is not known if the native American species, such as *Corylus cornuta* are susceptible.

GEOGRAPHICAL DISTRIBUTION

P. avellanae is reported from Greece (Drama, Kilkis, Katerina and Kavala provinces), Italy (Roma, Viterbo, Cuneo, Avellino, Rieti and Sardinia provinces) and Denmark (Copenhagen). This pathogen is not reported in other hazelnut growing areas, including North America.

BIOLOGY

This pathogen, originally described as *Pseudomonas syringae* pv. *avellanae* has recently been elevated to the species level and is now recognized as *Pseudomonas avellanae* (Psallidas) Janse *et al.* Bacterial pathogens in this genus commonly cause cankers or blight in plants. *P. avellanae* is a gram-negative rod shaped aerobic species. It is flagellated and capable of motility in fluids but it does not form spores or resting stages. Colonies are able to grow at high temperatures (30-35 °C) and also survive freezing.

Genetic tests show *P. avellanae* 'to be distantly related to ten more well known species such as *P. syringae*, *P. viridiflava* and *P. fluorescens*. This pathogen invades leaf scars in the fall and travels systemically throughout the tree. One third of infected trees may die in the first year post-infection (P.I.) and the remaining trees usually die in the second year P.I.. In one study, all eighteen cultivars tested and numerous wild seedling all suffered 100% mortality from a virulent strain of *P. avellanae* from Roma province. Epidemics are considered polycyclic (significant in-season spread from recently infected neighbors).

PEST SIGNIFICANCE

Economic Impact

During the past 25 years, a new bacterial pathogen of the European hazelnut has been spreading through the central continental production areas of Greece and Italy. Losses are most severe in Northern Greece and central Italy, where thousands of trees are killed annually. The disease is termed 'moria' in Italy and has killed more than 30,000 trees as of the summer of 2000. Other horticultural species are not reported as hosts of *P. avellanae*, although 'wild' hazelnuts are known to be hosts.

There appears to be some genetic resistance in some *Corylus* cultivars. Many cultivars are reported to be only moderately affected, however, numerous bacterial isolates with differing

pathogenicity to *Corylus* are now being reported and may account for less severe infections. Bacterial titer is also a factor in disease severity and rapidity of decline.

Oregon produces approximately 98% of the nation's hazelnuts. Commercial hazelnuts are planted on approximately 32,000 acres in Oregon and the 1999 crop value was over \$35 million dollars. The state of Washington produces the balance of the nation's hazelnuts. In addition to nut production, approximately 50 Oregon nurseries grow and sell ornamental and production *Corylus* stock. Sales of this stock is estimated at several millions of dollars in 1999.

Environmental Impact

Corylus spp. make up an major part of the riparian and woodland biota in the Pacific Northwest. These plants exist throughout the region from British Columbia south to California and east to Idaho. Populations of the native *C. cornuta* are found as far east as Newfoundland and south as Georgia. Many of the *Corylus* trees are escapes and have been naturalized. Seed of commercial trees are often 'planted' by passerine species of birds and small mammals. These naturalized trees then provide food and habitat for many bird and mammalian species. They are a prevalent understory species and an important component in the region's watersheds. Loss of these species would reduce food and shelter choices for wildlife and lower biodiversity. Loss could potentially effect erosion control efforts and soil stabilization.

Control

All isolates are reported to be copper sensitive in culture, however, the speed and lethality of this pathogen require strict quarantine and roguing. Also, many species of Pseudomonads are able to develop resistance to copper products. Products labeled for control of Pseudomonads are largely surface protectants and would have little effect against this systemic pathogen. The development of resistant varieties, which takes 10-15 years, is likely to be the only effective long-term control. No eradicants are known.

DETECTION AND IDENTIFICATION

Symptoms: Symptoms are first noted in spring following infection and include localized wilting, twig die-back, and eventually cankering. Plant death can occur in the same season or more commonly in the second year after infection.

Morphology: Colonies of *P. avellanae* are generally white to cream color and mucoid. Most colonies are fluorescent, this feature can be lost after several transfers. All strains tested are ice-nucleation negative and fail to accumulate poly- β -hydroxybuterate.

Testing Methods and Identification: This bacterium can be isolated from infected plant material using standard aseptic culture techniques. The standard battery of biochemical, nutritional and physiological tests can take six months. Repetitive polymerase chain reaction (rep-PCR) has recently been shown to be very effective in identifying field isolates of *P. avellanae* and can be conducted with published primers in a few days. Other species of *Pseudomonas*, existing as epiphytes, will be common on *Corylus* material.

MEANS OF MOVEMENT AND DISPERSAL

This bacterium is primarily wind-borne but can be carried by rain and insects. It appears that the pathogen can disperse throughout the late spring, summer and into fall within a block of trees.

Movement of cuttings and nursery stock would allow long distance dispersal.

Hazelnut Importation into Oregon. Oregon researchers, nurseries, growers and hobbyists are allowed to import *Corylus* from Europe through the Post-entry Quarantine (PEQ) program. *P. avellanae* is not listed as a pathogen of concern in the PEQ program. At this time, only *Anisogramma anomala* is a pathogen of concern. There have been four PEQ importations of nut-bearing trees from Italy to Oregon, totaling 192 plants since 1990. No PEQ importations are reported from Greece during the last ten years. One importation of ten trees from Denmark occurred in 1997. It is not clear from PEQ documentation what provinces were involved in providing the plant material.

Non-bearing *Corylus* plants (ornamental types) are exempt from PEQ and therefore are not put under observation and are allowed direct entry from foreign sources. It is clear that both *A. anomala* and *P. avellanae* infect ‘*contorta*’ and therefore they should be included in PEQ program as regulated stock as they can clearly serve as a source of introduction. It is not clear that *P. avellanae* will infect the ornamental varieties ‘*purpurea*’ or ‘*pendula*’, however *A. anomala* will infect ‘*pendula*’.

CRITICAL INFORMATION NEEDS

The lack of information on the susceptibility of native *Corylus* species is one of the key unknown issues. The lack of research on effective chemical control agents and their use and delivery leaves little in the way of treatment options. The response of many American varieties to the pathogen are unknown, but due to shared ancestry are likely to be similar to the response of European isolates.

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