



**NEW PEST ADVISORY GROUP (NPAG)**  
**Plant Epidemiology and Risk Analysis Laboratory**  
**Center for Plant Health Science & Technology**

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**NPAG Report**

***Chalara fraxinea* T. Kowalski: Ash dieback**

Ascomycetes / Incertae sedis  
ET Approval Date: 03/13/2009



Left: Mature *Fraxinus excelsior* tree showing extensive shoot, twig and branch dieback and the prolific formation of epicormic shoots (Laussa, Upper Austria, July 2007).  
Right: Wilting and blackish discoloration of foliage and necrotic lesions on a young ash tree from which *Chalara fraxinea* was isolated (Halmschlagler and Kirisits, 2008).

**Initiating Event and Pest Identification:** On 6 January 2009, the PPQ Executive Team requested that the NPAG rapidly address the risk posed by the fungus *Chalara fraxinea* (ash dieback). This fungus is known to contribute to widespread ash dieback in Scandinavian and Baltic countries. *Chalara fraxinea* poses an imminent threat to the United States, with a potential pathway for introduction through importation of ash plants for planting, seeds and wood (EPPO, 2008a; Labuschagne and Kotzé, 1991; Lingren, 2008). Currently, the United States prohibits the importation of ash (*Fraxinus* spp.) plants for planting from any country due to the presence of the emerald ash borer, although seeds are permitted (Importation of Ash Plants, 2008).

**Data Sheet:** Global Pest and Disease Database (GPDD; last updated November 5, 2008)

**Current PPQ Policy:** The Pest ID database lists the genus *Chalara* as reportable/actionable, but it does not list *C. fraxinea* (PestID, 2008, queried January 6, 2009). Pest ID lists three other *Chalara* species; *C. urceolata* is reportable/actionable, and *C. paradoxa* and *C. thielavioides* are non-reportable/non-actionable (PestID, 2008, queried January 6, 2009). No *Chalara* species are on the APHIS Regulated Plant Pest List (APHIS, 2000, queried January 6, 2009). No species of *Hymenoscyphus* sp. (teleomorph) are listed in PestID or on the APHIS Regulated Plant Pest List (APHIS, 2000; PestID, 2009: queried March 5, 2009).

**Pest Situation Overview:**

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**Exotic status:** *Chalara fraxinea* poses an imminent threat to the United States, with a potential pathway for introduction through importation of ash seeds and wood (EPPO, 2008a; Labuschagne and Kotzé, 1991; Lingren, 2008).

**Biology:** *Chalara fraxinea* has been identified as a causal agent of the intensive die-back of ash throughout Northern Europe (Kowalski, 2006). Large-scale ash dieback was first observed in the 1990s in the Baltic Sea area and has recently spread to other European regions (Dobrowolska et al., 2008). Symptoms begin at the top of the tree and include small necrotic spots on stems and branches. These spots enlarge, resulting in wilting and dieback of branches, death of the top of the crown, and eventually death of the trees (Dobrowolska et al., 2008; EPPO, 2008a; Halmschlager and Kirisits, 2008; Kowalski, 2006). Ash dieback affects trees of all ages, but is particularly severe on young saplings (Halmschlager and Kirisits, 2008). Symptoms of infection by *C. fraxinea* are often similar to those seen with infestation by the emerald ash borer (*Agrilus planipennis*). In addition to exit holes on trunk and branches, emerald ash borer infestation causes yellowing and thinning of the foliage, dieback of branches, dieback of the crown, epicormic shoots, and eventually death of the trees (CABI, 2007).

Little information is known regarding the biology of *Chalara fraxinea*, though it has been shown to be pathogenic to European ash (EPPO, 2008d; Kirisits et al., 2008; Kowalski and Holdenrieder, 2009a). The teleomorph of *Chalara fraxinea* has recently been shown to be *Hymenoscyphus albidus* (Helotiaceae, Helotiales), which is apparently native to and widespread in Europe (Kowalski and Holdenrieder, 2009b). This species is a known saprophyte, and the genus includes a number of species that are mycorrhizal (Kernaghan et al., 2003). Ascospores of *Hymenoscyphus albidus* are wind-transmitted, and are likely to be more important for dispersal than the sticky conidia of *C. fraxinea* (Kowalski and Holdenrieder, 2009b). *Chalara fraxinea* may be able to disperse aerially, but may be more likely to move in soil, water, plants for planting, or wood (EPPO, 2008a; Kile, 1993). Scientists studying *C. fraxinea* in Germany have found the fungus difficult to isolate, and have not found solid evidence for methods of transmission (Wulf, 2009).

Limited information is available regarding the extent and impact of ash dieback in Europe. By 2002, approximately 60 percent of all ash stands in Lithuania had been killed by ash dieback, and in certain parts of the country only 2 percent of *Fraxinus excelsior* remained visibly healthy (Vasaitis and Lygis, 2008). Eighty percent of ash stands in Poland are affected (Lingren, 2008). The reasons behind the recent emergence of ash dieback (*Chalara fraxinea*) from the widespread teleomorph, *Hymenoscyphus albidus*, are not clear. Kowalski and Holdenrieder (2009b) consider circumstances such as the possibility that the pathogen is an introduced species that is morphologically indistinguishable from the indigenous fungus, though they stress the need for additional research of the *H. albidus*-*C. fraxinea* complex. Alternatively, environmental changes and conditions, or potential changes in the behavior of the fungus may have resulted in the emergence of this new disease (Kowalski and Holdenrieder, 2009b).

There is some debate as to the primary cause of ash dieback. Additional research has been encouraged to determine whether *C. fraxinea* is a primary pest, or a secondary pest infesting trees with reduced resistance to disease due to other stress factors (Dobrowolska et al., 2008; EPPO, 2008a; Halmschlager and Kirisits, 2008; Jankovsky et al., 2008; Kowalski, 2006). The exact role of *C. fraxinea* in ash dieback is not clear, as it is commonly found in declining ash trees that are also colonized by other potentially pathogenic fungi such as species from *Cytospora*, *Diplodia*, *Fusarium*, *Phomopsis*, and *Armillaria* (Kowalski and Holdenrieder, 2009a). Vasaitis and Lygis (2008) postulated that: 1) *C. fraxinea* may be a natural component in the microfungi on ash trees and its pathogenicity may have been triggered by environmental factors, or 2) *C. fraxinea* may be a new invasive species gradually spreading over new areas along with the changing climate. Many European scientists have recently concluded that *C. fraxinea* is the primary causal agent of ash dieback (EPPO, 2008d; Kirisits et al., 2008; Norwegian Food Safety Authority, 2008; Wulf, 2009).

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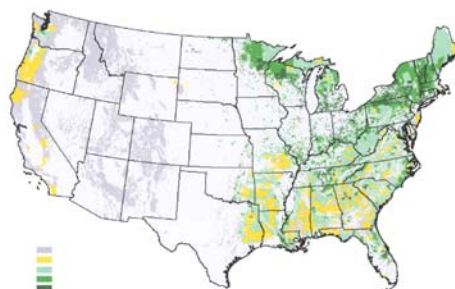
**Prevalence and global distribution: Europe:** Austria, Denmark, Czech Republic, Finland, Germany, Hungary, Lithuania, Norway, Poland, Slovenia, and Sweden (EPPO, 2008a; Jankovsky et al., 2008; Ogris et al., 2009; Thomsen, 2008).

In addition to the countries listed above, *C. fraxinea* is suspected to occur in Estonia, Latvia, and Switzerland based on symptoms observed in *F. excelsior* (EPPO, 2008a). Little information regarding the specific distribution of the teleomorph, *Hymenoscyphus albidus*, is available. It is described as “apparently native and widespread in Europe” (Kowalski and Holdenrieder, 2009b).

**Host range: Oleaceae:** *Fraxinus angustifolia* subsp. *danubialis* (narrow-leaved ash), *Fraxinus excelsior* (European ash), *Fraxinus excelsior* ‘Pendula’ (weeping ash) (EPPO, 2008a; Kirisits et al., 2008).

*Chalara fraxinea* primarily infects European ash (*F. excelsior*). While *C. fraxinea* has only been observed once on the additional species listed above (Kirisits et al., 2008), the fungus may affect other ash species which are present throughout the United States. In the literature, the teleomorph *Hymenoscyphus albidus* is known exclusively from *Fraxinus* petioles in leaf litter, though occasional apothecia have been found on dead shoots of young ash trees (Kowalski and Holdenrieder, 2009b).

**Potential distribution in the United States:** *Fraxinus excelsior* has a relatively limited distribution in the United States, found only in limited counties within Connecticut, Kentucky, Massachusetts, New York, and Ohio, as well as New Brunswick, Nova Scotia, Ontario, and Quebec, Canada (NRCS, 2009). Host/non-host experiments have not been performed for *C. fraxinea*, and we assume that it may infest other species of *Fraxinus*. Based on the current known distribution of ash dieback and the presence of ash trees throughout the United States, we estimate that this fungus may establish in most of the northern continental United States, particularly in the northeast and Midwestern states where ash (*Fraxinus* spp.) is most prevalent (see map below).



USDA Forest Service, n.d. (<http://www.na.fs.fed.us/fhp/eab/images2/ashdist.pdf>, accessed January 12, 2009). Volume density of ash (*Fraxinus* spp.) is mapped, ranging from 0 cubic feet per acre (gray) to greater than 100 cubic feet per acre (dark green).

**Potential pathways and spread:** *Chalara fraxinea* has been isolated from diseased twigs and branches, and dead roots of living ash trees (EPPO, 2008a). The fungus may be able to disperse aerially, in soil, water, plants for planting, or wood (EPPO, 2008a; Kile, 1993). Although data are lacking, it is thought that both plants for planting and wood of ash trees may disseminate *C. fraxinea* long distances (EPPO, 2008a). While ash plants for planting are prohibited, smuggling of oak and ash species from Poland into areas such as Chicago is relatively common (Rogers, 2009). The teleomorph, *Hymenoscyphus albidus*, is dispersed by the wind, and is likely to be more important for dispersal than the sticky conidia of *C. fraxinea* (Kowalski and Holdenrieder, 2009b). Insect vectors are also important in moving various *Chalara* sp. (Nag Raj and Kendrick, 1993; Webber and Brasier, 2001), though no specific species have been shown to vector *C. fraxinea*. Various *Chalara* species have been shown to be vectored primarily by flies and sap-feeding insects, as well as bark beetles (Nag Raj and Kendrick, 1993). The emerald ash borer does not appear to vector destructive fungi (NPAG, 2002a).

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Unidentified “sucking insects” may serve as vectors of *C. fraxinea* (Jankovsky et al., 2008). While no official documentation could be found regarding seed transmission of *C. fraxinea*, *C. elegans* is seedborne in peanut, and may transmit the pathogen (Labuschagne and Kotzé, 1991). Scientists at the Swedish University of Agricultural Sciences are concerned about *C. fraxinea* in seeds, and discourage planting ash trees at this time (Lingren, 2008). The United States Department of Agriculture has prohibited the importation of ash (*Fraxinus* sp.) plants for planting from any country (except portions of Canada) due to the presence of the emerald ash borer, but seeds are permitted (Importation of Ash Plants, 2008), as well as wood. A relatively small amount of tree and shrub seed is imported into the United States from Europe. During the past five calendar years (2003-2007), an average of 22 metric tons of tree and shrub seed, valued at \$344,000, were imported from Europe per year (Garrett, 2009). This amounted to 7% of the total imported tree and shrub seed quantity, and 12% of the value, worldwide (Garrett, 2009). The United States imports ash wood from Europe, although such imports have been steadily declining (Garrett, 2009). Ash wood imports from Europe made up 47% of the total ash wood imports in 2003, and were down to 17% in 2007 (Garrett, 2009).

**Control:** There is no information on effective control of *Chalara fraxinea* available. No resistant clones of European ash have been found so far (Lingren, 2008). Chemical control methods have had some success with other *Chalara* spp. (CABI, 2007; Labuschagne and Kotzé, 1996), and may be effective against *C. fraxinea* in seeds. Preventive measures such as sanitation, cultural methods, chemical control, and genetic resistance are important to prevent infection from *Chalara* spp. (Kile, 1993). Sanitation of equipment used near infected trees may reduce spread of the fungus (Kile, 1993; Norwegian Food Safety Authority, 2008). The effectiveness of wood treatments such as heat treatment and methyl bromide against this fungus is uncertain.

**Potential economic impacts:** While the economic impact of ash dieback in Europe has not been quantified, European ash is a native plant grown for forestry and amenity purposes (EPPO, 2008a) and the large-scale dieback throughout the area is likely causing significant impacts. Ash (*Fraxinus* spp.) is an important hardwood resource in the United States (Solomon et al., 1993), and also holds high value as an ornamental tree (NPAG, 2002b; Sumner, 2003). Complete loss of ash trees due to infestations by emerald ash borer has been estimated to be \$7.5 billion in Ohio alone (Sydnor et al., 2007). Given the widespread, intense ash dieback that has been seen in Europe, *C. fraxinea* has the potential to have similar impacts, if it is able to infest other *Fraxinus* species present in the United States. In 2007, the United States exported over \$87 million worth of ash (*Fraxinus* spp.) lumber (thickness >6mm), primarily to China (over \$17 million) and Canada (over \$10 million) (GTI, 2009).

**Potential environmental impacts:** Ash dieback is known to affect trees in forests, nurseries, and urban areas including parks and gardens in Europe (EPPO, 2008a). If *Chalara fraxinea* infects native ash trees in the United States, environmental impacts could be severe. As was described in the Emerald Ash Borer Risk Assessment (Fowler and Lakin, 2002), widespread dieback of ash in the United States would have high environmental impacts including impacts on natural community composition (e.g., reduce bio-diversity, affect native populations) and impacts on community structure (e.g., change density of a layer, cover the canopy, eliminate or create a layer). Additional impacts may include the use of chemical control agents.

**Trade implications:** EXCERPT lists 11 countries with phytosanitary concerns about *Chalara*: Nicaragua, Norway, China, Montenegro, Serbia, Former Republics of Yugoslavia, Republic of Korea, Namibia, Thailand, South Africa, and New Zealand. As a result of the quarantine measures Norway has recently established against *C. fraxinea*, all propagative materials are prohibited from entry in many areas of Norway (EPPO, 2008c; Norwegian Food Safety Authority, 2008). From EXCERPT, it appears that countries concerned about emerald ash borer (*Agrilus* sp. and *A. planipennis*) differ from those countries concerned about ash dieback, potentially increasing ash trade restrictions should *C. fraxinea* establish in the United States. Similarly to the phytosanitary measures taken in Norway (see

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current response and activities, below) it is likely that domestic movement of propagative materials within the United States would be restricted, and quarantine areas may be established.

**NPAG teleconferences:** None held.

**Current response and activities:** The United States Department of Agriculture has not taken any action against this species at this time. Norway began implementing phytosanitary regulations for *Chalara fraxinea* in September 2008 (EPPO, 2008c). Regulations in Norway include establishment of quarantine and observation zones, restrictions on the movement of *Fraxinus excelsior* plants for planting and disinfection of all pruning or mowing machinery prior to movement to an area which is free of the disease (EPPO, 2008c; Norwegian Food Safety Authority, 2008). Given the magnitude of the outbreak, Finland considers it impossible to eradicate *C. fraxinea*, but continues to monitor the disease in Finnish forests (EPPO, 2008b). The EPPO has placed *Chalara fraxinea* on the EPPO Alert List because of the serious threat to forest, amenity and nursery ash trees (EPPO, 2008a).

**Need for new technology or knowledge:**

- PPQ needs to know the specific etiology of ash dieback and the role of *Chalara fraxinea* and other organisms in causing the disease.
- PPQ needs to know the reasons behind the emergence of ash dieback from the native and widespread teleomorph *Hymenoscyphus albidus* in Europe.
- PPQ needs information regarding the potential for dispersal of *Chalara fraxinea* through seed and wood, as well as information on the potential of the teleomorph (*Hymenoscyphus albidus*) to be a mechanism for dispersal of ash dieback.
- PPQ needs to know the full distribution and host range of *Chalara fraxinea* and the teleomorph *Hymenoscyphus albidus*.
- PPQ needs information regarding detection and identification of *Chalara fraxinea* and the teleomorph *Hymenoscyphus albidus*.
- PPQ needs information regarding the potential for control of *Chalara fraxinea*.
- PPQ needs to know whether the saprophytic teleomorph, *Hymenoscyphus albidus*, is present in the United States.

**National Plant Board consultation:** None

**NPAG Recommended PPQ Policy:** The NPAG considers *Chalara fraxinea* to be a threat and recommends that PPQ establish a reportable/actionable policy. The NPAG recommends a reportable/actionable policy also be established for the teleomorph, *Hymenoscyphus albidus*.

**Approved Recommendations:**

1. NPAG recommends that PPQ Contact the USDA-ARS regarding potential research needs in identifying and determining the following: 1) the etiology of the disease, including the potential of the teleomorph to be a mechanism for dispersal, the potential for seed transmission, and the possibility it could be dispersed through wood; 2) the full host range and whether the widely distributed ash species in the United States are susceptible to infection; and 3) potential detection and control measures. **Action Leader: Phil Berger, PPQ CPHST.**
2. The NPAG recommends alerting emerald ash borer program leaders to the potential for establishment of *Chalara fraxinea* to notify them of another potential cause for ash dieback. **Action Leaders: Paul Chaloux, EDP, and Philip Bell, PPQ-ER.**
3. The NPAG recommends that USDA-APHIS-Offshore Pest Information Program (OPIP) work with International Services to obtain information on 1) the distribution and host list of *Chalara*

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*fraxinea* and its teleomorph *Hymenoscyphus albidus* in Europe, 2) the susceptibility of North American ash species present in Europe to the disease, and 3) and any research pertaining to modes of transmission that may have been conducted. **Action Leader: Parul Patel, PPQ-PHP.**

4. The NPAG recommends that this report be forwarded to the US Forest Service, for consultation and review. **Action Leader: Alison Neeley, PPQ-CPHST**

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