

# Involvement of *Chalara fraxinea* in Ash Dieback in Austria

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## Abstract

In many parts of Europe including Austria, common ash, *Fraxinus excelsior* is presently affected by a serious dieback of shoots, twigs and branches. Between June 2007 and July 2008 the presumable ash dieback pathogen, *Chalara fraxinea* was found at 31 localities in Austria. Apart from *F. excelsior*, the fungus was isolated at one locality each from *Fraxinus angustifolia* subsp. *danubialis* and *Fraxinus excelsior* 'Pendula'. Fungal isolations have shown that *C. fraxinea* is associated with early symptoms of ash dieback. Moreover, the pathogenicity of this fungus to *F. excelsior* has been confirmed in inoculation experiments. We suppose that the presently occurring ash dieback in Europe is not a complex disease, but an infectious disease caused by *C. fraxinea*.

**Keywords:** New forest health problem, fungal disease, *Fraxinus excelsior*, *Fraxinus angustifolia* subsp. *danubialis*, *Fraxinus excelsior* 'Pendula'

## Kurzfassung

### Beteiligung von *Chalara fraxinea* am Zurücksterben der Esche in Österreich

Die Esche (*Fraxinus excelsior*) ist gegenwärtig in vielen Teilen Europas und auch in Österreich von einem schwerwiegenden Zurücksterben der Triebe, Zweige und Äste betroffen. Der vermutete Erreger des Zurücksterbens der Esche, *Chalara fraxinea*, wurde zwischen Juni 2007 und Juli 2008 auf 31 Fundorten in Österreich nachgewiesen. Abgesehen von *F. excelsior* wurde der Pilz an je einem Standort von *Fraxinus angustifolia* subsp. *danubialis* und von *Fraxinus excelsior* 'Pendula' isoliert. Die Pilz-Isolierungen haben gezeigt, dass *C. fraxinea* mit den Frühsymptomen des Zurücksterbens der Esche assoziiert ist. Ferner wurde die Pathogenität dieses Pilzes gegenüber *F. excelsior* in Inokulationsversuchen bestätigt. Wir nehmen an, dass es sich beim gegenwärtig in Europa auftretenden Zurücksterben der Esche nicht um eine Komplexkrankheit handelt, sondern um eine Infektionskrankheit, die von *C. fraxinea* hervorgerufen wird.

**Schlüsselworte:** Neuartiges Forstschutzproblem, Eschen-Triebsterben, *Fraxinus excelsior*, *Fraxinus angustifolia* subsp. *danubialis*, *Fraxinus excelsior* 'Pendula'

Since the early 1990s common ash, *Fraxinus excelsior* has been affected by a new forest health problem, known as ash dieback (Figure 1). Ash dieback was first

observed in Poland and now it occurs in many European countries (Przybył 2002, Kowalski 2006, Kowalski & Holdenrieder 2008). In Austria, dieback of *F. excelsior* was first noticed between 2003 and 2005 and since 2006 it has been widespread and serious in many parts of the country (Cech & Hoyer-Tomiczek 2007, Cech, pers. comm., 2008, Kirisits et al. 2008).

## Symptoms of ash dieback

Symptoms of this new syndrome include necrosis of leaf rachises and leaflet veins, shoot, twig and branch dieback (Figure 1) as well as necrotic lesions and cankers in the bark. Bark necrosis is often accompanied by brownish to greyish discolouration of the wood that frequently extends longitudinally beyond necrotic areas in the bark. Wilting of leaves can sometimes be seen on recently girdled shoots and twigs. Diseased trees react with prolific formation of epicormic shoots (Figure 1). The syndrome occurs on ash trees of all ages, both on natural regeneration and on planted trees. In Austria, mortality of mature trees has thus far only been observed in exceptional cases, but it is common amongst saplings and younger trees.

## Suggested causes of ash dieback

Ash dieback was initially thought to be primarily caused by abiotic factors (early, winter and late frosts, drought and abrupt changes of periods with warm and cold weather conditions), with secondary, weakly virulent fungal pathogens and endophytes (e. g. *Diplodia mutila*, *Phomopsis* spp.) contributing to the syndrome (Przybył 2002, Pukacki & Przybył 2005, Cech & Hoyer-Tomiczek 2007). Accumulating evidence now suggests, however, that the recently described hyphomycete *Chalara fraxinea* (Figure 2) is involved in this unprecedented dieback of common ash in Europe (Kowalski 2006, Kowalski & Holdenrieder 2008).

## *Chalara fraxinea* in Austria

Starting in June 2007, we aimed to examine the possible involvement of *C. fraxinea* in ash dieback in Austria (Halmschlagler & Kirisits 2008). Following the methods of Kowalski (2006) the fungus was isolated from necrotic lesions on leaf rachises, leaflet veins, dead shoots, necrotic lesions in the bark and discoloured xylem of diseased ash trees. Between June 2007 and July 2008



Figure 1: Mature, solitary *Fraxinus excelsior* tree affected by ash dieback (Laussa, Upper Austria, July 2007).

Abbildung 1: Solitäresche mit starkem Trieb-, Zweig- und Aststerben (Laussa, Oberösterreich, Juli 2007)

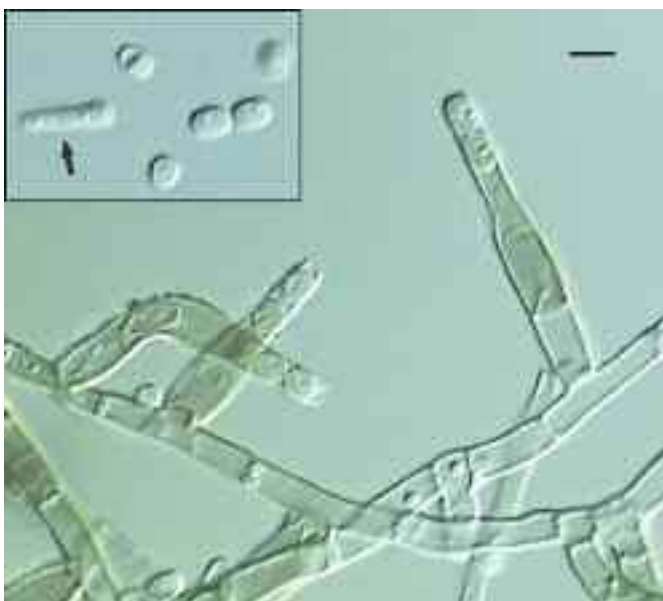


Figure 2: Phialophores and conidia (inset) of *Chalara fraxinea*. The arrow in the inset indicates a first-formed conidium. Bar = 4  $\mu$ m.

Abbildung 2: *Chalara fraxinea*: Phialophoren und Konidien (Bildausschnitt). Der Pfeil im Bildausschnitt weist auf eine zuallererst gebildete Konidie hin. Balken = 4  $\mu$ m.

*C. fraxinea* was found at 31 Austrian localities, including 16 localities in the Province of Lower Austria and five localities each in the Provinces of Vienna, Upper Austria and Styria (Kirisits et al. 2008). In one case the fungus was detected in a forest nursery. At 29 sites *C. fraxinea* was isolated from young *F. excelsior* trees, at one site from young narrow-leaved ash (*Fraxinus angustifolia* subsp. *danubialis*) trees and, in a park in Vienna, from weeping ash (*Fraxinus excelsior* 'Pendula') trees (Kirisits et al. 2008). The latter are the first and thus far only records of the fungus from a host other than *F. excelsior*.

Isolation of *C. fraxinea* proved to be difficult from trees showing late symptoms of disease, especially from tissues bearing fruiting bodies of other fungi. We suppose that on such plant material the slow growing *C. fraxinea* is in most cases already outcompeted by fast-growing endophytic or saprotrophic fungi. However, when isolations were made from shoots, twigs and stems showing early symptoms of disease (Figure 3) *C. fraxinea* was the most common fungus and in most cases the only one that was recovered.

### Ash dieback: A new fungal disease

Kowalski & Holdenrieder (2008) reported the proof of pathogenicity of *C. fraxinea* to *F. excelsior*. This has been confirmed in own, presently ongoing inoculation experiments (Kirisits et al. 2008). Based on studies in Poland (Kowalski 2006, Kowalski & Holdenrieder 2008) and our preliminary results from Austria (Halmschlager & Kirisits 2008, Kirisits et al. 2008) we suppose that ash dieback is not a complex phenomenon, but an infectious disease, with *C. fraxinea* as primary causal agent.

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Figure 3: Small necrotic lesions on shoots of young *Fraxinus excelsior* trees prior to budburst (Schafberg, Vienna, mid-April 2008). *Chalara fraxinea* was the most common and in most cases the only fungus isolated from these shoots showing early symptoms of ash dieback.

Abbildung 3: Kleine Rindennekrosen an Trieben von jungen Eschen vor dem Austrieb (Schafberg, Wien, Mitte April 2008). *Chalara fraxinea* war der häufigste und meistens der einzige Pilz, der von diesen Trieben mit Frühsymptomen des Eschentriebsterbens isoliert wurde.