Department for Environment, Food and Rural Affairs

CHALARA FRAXINEA – KEY SCIENTIFIC FACTS

Background

Ash dieback is a disease of ash trees caused by the fungus *Chalara fraxinea*[1]. The disease causes leaf loss and crown dieback in affected trees and it may lead to tree death. Ash trees suffering from symptoms likely to be caused by *Chalara fraxinea (C. fraxinea)* are increasingly being found across Europe. These have included forest trees, trees in urban areas and also young trees in nurseries. *C. fraxinea* is a quarantine pest under national emergency measures.

Confidence ratings as used below:

High – supported by experimental evidence and repeated observations which have been published in the peer-reviewed scientific literature.

Moderate – supported by long-term observation or multiple observations from reputable sources that come to the same conclusion, or by comparative analysis of related species.

Low – supported by a few observations or many observations from reputable sources that are not suggesting a consistent pattern, or an accumulation of anecdotal evidence that suggests a consistent pattern.

What is Chalara dieback of ash?

1. Chalara dieback of ash is a disease of ash trees caused by the fungus *Chalara fraxinea* (Kowalski, 2006). The disease causes loss of leaves, dieback of the crown of the tree and can lead to tree death (Kowalski and Holdenrieder, 2009). (*High confidence*)

2. *C. fraxinea* has infected many species of ash but with differing intensities (Forest Research, 2012). As some ash species show very few symptoms after infection, they may act as undetected carriers. There is evidence of low susceptibility to disease in some Asian ash trees (Drenkhan and Hanso, 2010). (*Moderate confidence)*

3. Common ash (*Fraxinus excelsior*) is the most severely affected species. Young trees are particularly vulnerable to *C. fraxinea* and succumb to disease rapidly. (Kowalski, 2006; Forest Research, 2012). (*High confidence*)

4. Ash dieback has seriously affected a high percentage of ash trees in continental Europe (Forest Research, 2012; Bakys *et al*., 2009; Engesser *et al*., 2009; Halmschlager and Kirisits, 2008; Ioos *et al*., 2009; Kowalski and Holdenrieder, 2008; Lygis *et al*., 2005; Ogris *et al*., 2010; Szabo, 2009; Talgo *et al*., 2009), most notably in Scandinavia (including Denmark, which has an estimated 90 per cent of ash trees infected) and Baltic States. (*High confidence)*

5. There is no evidence that *C. fraxinea* can spread to tree species other than ash or that it is harmful to the health of people or animals. (*High confidence)*

How does infection happen?

[1] *Chalara fraxinea* is the asexual form (anamorph) of *Hymenoscyphus pseudoalbidus,* responsible for the current ash dieback epidemic in Europe (Kowalski, 2006; Queloz *et al.,* 2010). For ease of reference, *Chalara fraxinea* is used as the common term in this document.

6. Infection is via spores from fruit bodies on leaf litter. Spore production (in fruit bodies) occurs on infected fallen leaves and shoot material in the growing season after infection; trees are likely to need a high dose of spores to become infected (Timmermann *et al*., 2011). (*High confidence)*

7. *C. fraxinea* infection starts primarily on leaves and is progressive over time with dieback and stem lesions usually manifesting in the next growing season. Leaf symptoms can be detected within two months of infection (experience from Denmark). (*Moderate confidence)*

8. *C. fraxinea* causes infection from June – October, mainly in July – August (Timmermann *et al*., 2011; Kirisits and Cech, 2009; Kowalski and Holdenreider, 2009). Moist conditions favour production of the fruiting bodies. (H*igh confidence)*

How is infection likely to spread?

9. Spores are produced on *Chalara* fruit bodies formed on fallen leaves and shoots the year following infection. Natural spread is by wind-blown spores (ascospores) from these fruiting bodies (Kowalski, 2006; Kirisits *et al.*2009; Kowalski and Holdenrieder, 2009; Queloz *et al.,* 2010). (*High confidence)*

10. Wind-blown spores may be dispersed up to 20-30 kilometres (Solheim, *et al*., 2011). Longer distance spread occurs via infected plants or potentially via wood products (Husson et al, 2012; EPPO, 2010; Prokrym and Neeley, 2009). (*High confidence* on wind dispersal; *Moderate confidence* on untreated wood products).

11. There is low probability of dispersal on clothing and footwear or via animals and birds. *(High confidence)*. Transmission by routes other than wind and planting material are likely to pose a comparatively low risk but the risk cannot be ruled out.

12. *C. Fraxinea* is found in seeds (Cleary M., *et al.* 2012) this is reflected in the legislation which restricts the movement of plants and seeds.

13. There is lower risk of *C. fraxinea* spreading over the winter since there is now a ban on ash imports into the UK, restrictions on plant movements through Statutory Plant Health Notices and as spore production is not expected to resume until June 2013. (*High confidence)*

14. Scientific advice from Norway suggests a disease progression rate of up to 30 km per year once *C. fraxinea* is established (Solheim, 2009; Solheim, *et al*., 2011). (*High confidence)*

What are the consequences of infection for ash tree health?

15. Trees cannot recover from infection but larger trees can survive infection for a considerable length of time and some may not die (current experience from Denmark). (*High confidence)*

16. The impact of *C. fraxinea* infection depends on tree age, location, weather conditions and co-presence of honey fungus (*Armillaria*) or other secondary pathogenic / opportunistic organisms. Trees in forests are more susceptible because of the greater prevalence of honey fungus. Timber trees are generally felled before they are killed by honey fungus.
    - Trees under 10 years of age are likely to die from *C. fraxinea* in 2-10 years.

- Trees under 40 years old will die in 3-5 years if also infected with honey fungus, and likely more rapidly if the tree is already debilitated.
- For mature trees over 40 years, there is no direct evidence of tree deaths just from *C. fraxinea* to date but there is little comprehensive survey data from Europe on which to base firm conclusions.

(Moderate confidence)

Further evidence would be helpful to strengthen the development of management options to minimise the environmental, economic and social impacts of *Chalara fraxinea,* including:

- Improving detection of *Chalara.*
- Improving knowledge of the aetiology, pathology and epidemiology of *Chalara.*
- Understanding the nature and scale of the environmental, economic and social impacts of *Chalara.*
- Assessing how to mitigate the risks of *Chalara*.
- Assessing how to adapt to the presence of *Chalara*.

References:

Bakys R, Vasaitis R, Barklund P, Ihrmark K and Stenlid J (2009). Investigations concerning the role of *Chalara fraxinea* in declining *Fraxinus excelsior*. Plant Pathology 58, 284-292.

Cleary M, Arhipova N, Gaitnieks, T Stenlid J and Vasaitis, R (2012) Natural infection of Fraxinus excelsior seeds by Chalara fraxinea Forest Pathology: 1-8

Engesser R, Queloz V, Meier F, Kowalski T and Holdenrieder O (2009). Das Triebsterben der Esche in der Schweiz. Wald u. Holz 6, 24–27.

EPPO (2010). Workshop on *Chalara fraxinea*, Oslo, Norway, 30 June to 2 July 2010. http://archives.eppo.int/MEETINGS/2010_conferences/chalara_oslo.htm.

Forest Research (2012). Rapid assessment of the need for a detailed Pest Risk Analysis for *Chalara fraxinea.* http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/documents/chalaraFraxinea.pdf.

Halmschlager E and Kirisits T (2008). First report of the ash dieback pathogen *Chalara fraxinea* on *Fraxinus excelsior* in Austria. New Disease Reports 17. http://www.bspp.org.uk/publications/new-disease-reports/july2008/2008-25.asp.

Husson C, Caël O, Grandjean J-P, Nageleisen L-M and Marçais B (2012). Occurrence of Hymenoscyphus pseudoalbidus on infected ash logs. Plant Pathology 61: 889-895.

Ioos R, Kowalski T, Husson C and Holdenrieder O (2009). Rapid *in planta* detection of *Chalara fraxinea* by a real-time PCR assay using a dual-labeled probe. European Journal of Plant Pathology 125, 329-335.

Kirisits T and Cech TL (2009). Zurücksterben der Esche in Österreich: Ursachen, Verlauf, Auswirkungen und mögliche Forstschutz- und Erhaltungsmaßnahmen.

Kirisits T, Matlakova M, Mottinger-Kroupa S, Cech TL and Halmschlager E. (2009). The current situation of ash dieback caused by Chalara fraxinea in Austria. In: Proceedings of the Conference of IUFRO Working Party 7.02.02, Egˇ irdir, Turkey, 11–16 May 2009. (Ed. by Dogmus-Lehtija T.) SDU Faculty of Forestry Journal, ISSN: 1302-7085, Serial: A, Special Issue: pp. 97–119.

Kowalski T (2006). *Chalara fraxinea* sp. nov. associated with dieback of ash (*Fraxinus excelsior*) in Poland. *Forest Pathology* 36, 264-270.

Kowalski T and Holdenrieder O (2008). A new fungal disease of ash in Europe. Schweiz. Z. Forstwes 159, 45–50.

Kowalski T and Holdenrieder O (2009). Pathogenicity of *Chalara fraxinea*. Forest Pathology 39, 1–7.

Lygis V, Vasiliauskas R, Larson K-H and Stenlid J (2005). Wood-inhabiting fungi in stems of *Fraxinus excelsior* in declining ash stands of northern Lithuania, with particular reference to *Armillaria cepistipes*. Scandinavian Journal of Forest Research 20, 337-346.

Ogris N, Hauptman T, Floreancig V, Marsich F and Montecchio L **(**2010). First report of *Chalara fraxinea* on common ash in Italy. Plant Disease 94(1): 133. DOI: 10.1094/PDIS-94-1-0133A.

Queloz V, Grünig CR, Berndt R, Kowalski T, Sieber TN and Holdenrieder O (2010). Cryptic speciation in *Hymenoscyphus albidus*. Forest Pathology. doi: 10.1111/j.1439-0329.2010.00645.x. http://onlinelibrary.wiley.com/doi/10.1111/j.1439-0329.2010.00645.x/pdf

Prokrym DR and Neeley AD (2009). NPAG Report. *Chalara fraxinea* (T. Kowalski): Ash dieback. Ascomycetes / Incertae sedis. ET Approval Date: 03/13/2009. New Pest Advisory Group (NPAG) Plant Epidemiology and Risk Analysis Laboratory Center for Plant Health Science & Technology.

Szabo I (2009). First report of *Chalara fraxinea* affecting common ash in Hungary. Plant Pathology 58, 797.

Solheim H (2009). Bekymringsfull økning i askeskuddsjuka: Trær ser ut til å dø. Skogeieren 96 (7-8): 24-25.

Solheim H, Timmermann V, Børja I & Hietala AM (2011). Yggdrasils helsetilstand - Askeskuddsjuke er på frammarsj. Skogeieren 96 (1): 34-36.

Talgo V, Sletten A, Brurberg MB, Solheim H, and Stensvand A (2009). *Chalara fraxinea* isolated from diseased ash in Norway. Plant Disease 93(5): 548. DOI: 10.1094/PDIS-93-5-0548A.

Timmermann V, Børja I, Hietaka AM, Kirisits T and Solheim H (2011). Ash dieback: pathogen spread and diurnal patterns of ascospore dispersal, with special emphasis on Norway. EPPO Bulletin, 41: 14-20. doi: 10.1111/j.1365-2338.2010.02429.x