

Neonectria canker of *Abies*

Summary

Although records of *Neonectria* canker disease go back more than 100 years in Europe, in 2008 a new and more severe form of the disease on firs was reported in Norway and, in 2011, the same disease was confirmed in Denmark. In 2013 it was highlighted by the EPPO (European Plant Protection Organisation) Reporting Service as a new and emerging disease caused by the pathogen known as *Neonectria neomacrospora*. Since then there have been several findings of the same disease on various species of fir in the UK.

Introduction

A *Neonectria* disease was first described from grafted *Abies concolor* (white fir) in a German nursery more than 100 years ago. The same disease has also been known in Norway for decades although high levels of damage were only first reported on *A. concolor* in 2008. It has been established that the causal agent is the fungal pathogen *Neonectria neomacrospora* which is also likely to have been present in Denmark for many years although only relatively recently reported on *A. lasiocarpa* (subalpine fir) in 2011. The pathogen was then detected on *A. concolor* in Sweden in 2015, although symptoms were first observed earlier in 2009. As a result of these various findings, the disease was highlighted by the EPPO (European Plant Protection Organisation) Reporting Service as an emerging disease in 2013 (<https://gd.eppo.int/reporting/article-2696>).

In Britain there have been historical reports of *N. neomacrospora* on *A. cephalonica* (Greek fir) in Argyll and *A. concolor* in Gloucestershire associated with severe twig canker and dieback at least since the 1950s and also on *A. procera* in Wales in the 1990s where it caused extensive cankers and dieback; at the time of those earlier records the pathogen was known as *Nectria cucurbitula* or *N. macrospora*. However, no further reports were made until 2015 when the same pathogen was isolated from *A. kawakamii* (Taiwan fir) in an arboretum and *A. alba* (European silver fir) in a garden. Subsequently it has been identified causing dieback on a wide range of fir species in the UK (Table 1) and it is also a long-standing cause of canker disease of fir in North America.

Symptoms

Dead shoots, dead branches (Figure 1), cankers, heavy resin flow and dead trees when cankers completely girdle the trunk (Figure 2) can all be associated with infection caused

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by *N. neomacrospora*. Distinctive red fruit bodies (perithecia) may also form on branches that have been dead for at least a year (Figure 3), especially where dead needles accumulate on lateral branches. The most vulnerable stage for infection and damage appears to be during shoot elongation and there is a suggestion that sheering of trees for Christmas tree production in October can also create wounds that favour infection.



Figure 1. Dead shoots and branches on *A. alba*



Figure 2. Dying *A. kawakamii*



Figures 3 and 4. Red fruiting bodies (perithecia) emerging from bark of *A. procera* (left) and in close-up (above)

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Hosts

Table 1. The recorded hosts for *N. neomacrospora* (November 2016) worldwide

Species	Common name	Recorded in		
		UK	Europe ¹	N. America ³
<i>A. alba</i>	European silver fir	+	+	+
<i>A. balsamea</i>	Balsam fir	+		+ ²
<i>A. durangensis</i>	Durango's fir	+		
<i>A. fraseri</i>	Fraser fir	+		+
<i>A. kawakamii</i>	Taiwan fir	+		
<i>A. lasiocarpa</i>	Subalpine fir	+	+	+
<i>A. magnifica</i>	Red fir	+		
<i>A. pinsapo</i>	Spanish fir	+	+	+
<i>A. procera</i>	Noble fir	+	+	+
<i>A. vejarii</i>	Vejar's fir	+		
<i>A. amabilis</i>	Pacific silver fir		+	+
<i>A. balsamea</i> var. <i>phanerolepis</i>	Canaan fir			+
<i>A. bornmuelleriana</i>	Turkish fir			+
<i>A. cephalonica</i>	Greek fir	+	+	+
<i>A. concolor</i>	White fir	+	+	+
<i>A. fargesii</i>	Farges' fir		+	
<i>A. grandis</i>	Grand fir	+	+	+
<i>A. koreana</i>	Korean fir		+	+
<i>A. magnifica</i> var. <i>shastensis</i>	Shasta red fir			+
<i>A. nebrodensis</i>	Sicilian fir		+	
<i>A. nordmanniana</i>	Nordmann fir		+	+
<i>A. numidica</i>	Algerian fir			+
<i>A. sibirica</i>	Siberian fir		+	
<i>Picea abies</i>	Norway spruce		+	
<i>Tsuga heterophylla</i>	Western hemlock		+	+

¹Talgø *et al.* 2013, ²Ouellette & Bard 1966, ³Talgø *et al.* 2014

How it spreads

Evidence suggests that *N. neomacrospora* spores can spread aurally, as windborne spores have been detected in spore traps placed near cankered branches. Insects such as the small fir bark beetle (*Cryphalus piceae*) have also been suggested as vectors, as this species of bark beetle has become prominent in Denmark at around the same time as the disease was first reported. However, although *Neonectria* disease and *C. piceae*

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are often found together on affected trees, there is no confirmed link so it may be that the beetle is simply able to take advantage of disease-stressed trees. The needle and shoot sucking aphid (*Adelges* sub gen. *dreyfusi*) does appear to have a role in increased levels of fungal attack based on a statistical correlation between the amount of damage and the occurrence of the aphid. In Britain, cultures of *N. neomacrospora* have been isolated from the distorted twig growth caused by adelgid feeding (see Figure 4).



However, the disease can also occur in the absence of adelgid damage.



Figure 4. Adelgid damage, cross-section of the distorted growth and cultures of *N. neomacrospora* from this material

Where has it been found?

Findings of *Neonectria* canker in the UK have included forest plantations (on *A. procera*), gardens and arboreta (various *Abies* spp.). To date there have been no findings in Christmas tree plantations.

In Norway and Denmark, damage has been seen in landscape plantings, Christmas tree and foliage production fields, and is now widespread in some forest stands. The pathogen has also been found associated with seeds and on trees in a Nordmann fir seed orchard (Figure 5). Testing of seeds from diseased Nordmann and sub-alpine fir has shown high levels of infection by *N. neomacrospora*, suggesting that the disease could

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be seed-transmitted, although no impacts have yet been seen in nursery seedlings where infected seed could have been the disease source (Iben Thomsen, pers comm.)

Control measures

Currently the only steps which can be taken to limit the spread of infection by *N. neomacrospora* are those based on hygiene and sanitation. Where practical, affected branches or shoot tips should be removed, cutting back to the healthy wood. Stringent biosecurity measures should also be taken to clean tools and reduce the possibility of spread from tree to tree as well as between sites. Consideration should be given to the risk posed by introducing new plants to sites where the disease is not present.



Figure 5. *Abies lasiocarpa* in a Norwegian seed orchard (image courtesy of Venche Talgø, Norsk institutt for bioøkonomi)

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