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Extended Abstract

Neonectria-canker on trees in Norway

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Neonectria spp. have been found on a number of tree species in Norway. *Neonectria ditissima* is commonly detected from diseased trees in apple orchards and a *N. ditissima*–like species has caused an epidemic on white fir (*Abies concolor*).

In Norway, *Neonectria* spp. attack numerous plant species including true fir (*Abies* spp.), sycamore maple (*Acer pseudoplatanus*), alder (*Alnus glutinosa*) (Figure 1), dogwood (*Cornus* sp.), ash (*Fraxinus excelsior*), holly (*Ilex aquifolium*) (Figure 2), apple (*Malus* × *domestica*), spruce (*Picea abies*), poplar (*Populus* sp.), bird cherry (*Prunus padus*), pear (*Pyrus* sp.), and rowan (*Sorbus aucuparia*). Attacks by *Neonectria* spp. may result in canker wounds and dieback. Red fruiting bodies (perithecia) containing asci and ascospores are often present. Usually they form clusters that are clearly visible to the naked eye. In culture, *Neonectria* spp. produce microconidia (*Cephalosporium* spp.) and macroconidia (*Cylindrocarpon cylindrioides*).

Neonectria-canker is a serious problem in Norwegian apple orchards (Figure 3), and in 2010 we investigated if host plants other than apple trees were potential inoculum sources. We sequenced the internal transcribed spacer (ITS)-regions from *Neonectria* cultures isolated from apple trees and two other host plants in the rose family (*Rosaceae*); rowan (*S. aucuparia*) (Figure 4) and bird cherry (*P. padus*) (Figure 5). Cultures from all 3 hosts produced floccose, white mycelium. The cultures had identical sequences and they were identical to the sequences of *N. ditissima* (syn. *Neonectria galligena*) deposited in GenBank. Inoculation tests have not yet taken place, thus, we have no indications that cross infections take place in nature. Further research is needed to find out if infected rowan or bird cherry in the vicinity of apple orchards may increase the disease pressure.

Interestingly, cultures isolated from dying conifers in Norway in 2008 differed from *N. ditissima* by five out of the 550 base pairs included in the ITS-sequence. Previously, *Neonectria fuckeliana* has been reported on spruce species in Norway, and on spruce and fir species in other countries, but *N. fuckeliana* differs by more than 20 base pairs from the *N. ditissima*-like isolates we obtained from conifers in 2008. The *N. ditissima*-like fungus might be a new species related to *N. ditissima*, possibly imported to Norway. *N. ditissima* has to our knowledge never been described as a pathogen on conifers, but the *N. ditissima*-like fungus we isolated from conifers in 2008 was clearly pathogenic. We first discovered a serious disease outbreak on white fir (*Abies concolor*) in southern Norway (Figure 6), and the *N. ditissima*-like fungus was isolated from dying trees in two counties in south western and four counties in south eastern Norway. Both old and young trees were dead or dying. The *N. ditissima*-like fungus was later isolated from Siberian fir (*A. sibirica*), subalpine fir (*A. lasiocarpa*), and Norway spruce (*Picea abies*) in south eastern Norway. Perithecia in canker wounds from the conifer samples were dark around the ostiole. This morphological characteristic is known from *N. ditissima,* but not from *N. fuckeliana*. Sequencing showed that all the *Neonectria*-isolates from different conifer hosts in 2008 were identical in their ITS-region. The cultures were white. Cultures from *N. fuckeliana* are brownish. *N. fuckeliana* is common on Norway spruce in our country (Roll-Hansen and Roll-Hansen, 1995), and commonly associated with dieback on white fir in Europe and western North America (Callan, 1997). In Canada, *N. fuckeliana* caused dieback on subalpine fir (*A. lasiocarpa*) (Funk, 1981).

Inoculation tests with *N. ditissima*-like isolates were carried out in 2009 on subalpine fir, white fir, and Norway spruce. Map pins (16 mm SHF top grip map pins, Pålsboda, Sweden) were used to inoculate and easily trace the inoculation points. The pins were autoclaved and placed on potato dextrose agar (PDA) together with an agar plug (0.5 mm in diameter) from the *Neonectria*–culture to be tested. After approximately one week at room temperature the pins were covered with mycelium, and the needle tips were inserted into the bark or dormant buds (3 pins or more were inserted

per plant – depending on the size and shape of the plant). As a control, unwounded trees or trees wounded by autoclaved map pins from sterile PDA were used. The fungus was pathogenic on all three fir species tested. Figure 7 shows symptoms on inoculated subalpine fir. Control trees showed no symptoms.

Key words: *Neonectria fuckeliana, Neonectria ditissima, Abies, Picea, Malus, Sorbus, Prunus*.

Figure 1. *Neonectria* sp. on alder (*Alnus glutinosa*) (left); discoloration below infected bark (middle), and red perithecia (right). Photos: Venche Talgø.

Figure 2. In natural stands of holly (*Ilex aquifolium*) on the west coast of Norway (left) damage by *Neonectria* sp. has occasionally been found (middle and right). Photos: Venche Talgø.

Figure 3. *Neonectria ditissima* on apple (*M* × *domestica*); red fruiting bodies (perithecia) on apple tree branches (left and middle) and dead tissue in a canker wound (right). Photos: Venche Talgø.

Figure 4. *Neonectria ditissima* on rowan (*Sorbus aucuparia*); malformed branches and twigs (left and middle) and red perithecia in a canker wound (right). Photos: Venche Talgø.

Figure 5. *Neonectria ditissima* on bird cherry (*Prunus padus*); swellings and canker wounds (left), red perithecia (middle), and a whitish culture with light brown patches (right). Photos: Venche Talgø.

Figure 6. White fir (*Abies concolor*) attacked by a *Neonectria ditissima*-like fungus; dead and dying trees (left), slightly sunken canker wound (middle), and resin flow (right). Photos: Venche Talgø.

Figure 7. Subalpine fir (*Abies lasiocarpa*) inoculated with a *Neonectria ditissima*-like fungus isolated from subalpine fir; dieback symptoms on inoculated plants compared to control plants (left), resin flow and sunken, discoloured bark (middle), and dead shoot (right). Photos: Venche Talgø.

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