



First report of *Neonectria neomacrospora* on *Abies concolor* in Finland

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In February 2018, *Abies concolor* (white fir) trees with shoot dieback were detected in an arboretum located in southeast Finland. Closer examination of the diseased firs revealed bleeding stems, branch cankers and necrotic shoots with shedding needles (Fig. 1). Under the microscope red perithecia were observed in the needle scars of dying shoots. In the arboretum, deterioration and poor survival of white fir had been noticed since the 1980's with more than 90% of firs of various ages showing decline symptoms.

In the laboratory, both perithecia and shoot sections from the margin of necrotic tissues were used for fungal isolation. The samples were surface sterilised for one minute in 70% ethanol, for three minutes in a 4% sodium hypochlorite solution and for 30 seconds in 70% ethanol after which they were dipped in sterile water and air-dried for ten minutes. Samples were placed on potato dextrose agar and incubated at 21°C in the dark. Within a few days white mycelium emerged from the samples and rapidly colonised the agar surface (Fig. 2). Ovoid to ellipsoid microconidia with an average size of 4-12 × 2-5 µm and straight one to three-septate round-ended macroconidia (12-60 × 4-6 µm) were observed in culture (Fig. 3).

DNA extracted from a pure fungal culture was PCR-amplified with ITS1 and ITS4 primers (White *et al.*, 1990; Gardes & Bruns 1993). The obtained nucleotide sequence was identified as *Neonectria neomacrospora* by aligning it with sequences in the NCBI Genbank using BLAST. The sequence was deposited in the database of NCBI (Genbank Accession No. MH580206).

Inoculations of two-year-old seedlings of *Abies balsamea*, *A. fraseri* and *A. sibirica* as well as of Norway spruce (*Picea abies*) were performed by placing a piece of agar-growing mycelium on top of a fresh needle scar on the stem. Inoculated seedlings were grown in plastic trays of 64 or 81 cells in fertilised peat (Kekkilä Oy, Finland). These were placed in a greenhouse at 20°C with 50-70% humidity and a 16 hr photoperiod. In all *Abies* species *N. neomacrospora* infection led to top dieback (Fig. 4). On Norway spruce resin-bleeding stem cankers were induced by the pathogen. In all cases, *N.*

neomacrospora was reisolated from the inoculated seedling stem sections as described above.

Recently, increased incidence of *N. neomacrospora* has been reported in several European countries (EPPO, 2013; Pérez-Sierra *et al.*, 2016; Pettersson *et al.*, 2016; Schmitz *et al.*, 2017) and the species is included in the EPPO Alert list. In Finland, firs are mainly used as landscaping and ornamental trees as well as grown for Christmas trees. Surveying the occurrence of *N. neomacrospora* in Finland has started.

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Figure 1



Figure 2



Figure 3



Figure 4

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