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Faculty of Science

Plant pathogenic fungi on Nordmann fir seeds

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Nordmann fir *Abies nordmanniana*



- Important Christmas tree species in Europe.
- 10 mill. trees produced in Denmark every year.



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Nordmann fir *Abies nordmanniana*

- Long term breeding programs in Denmark
- Average seed use in DK 22,7 tons pr year
- < 10% Danish seeds, but expected to increase.
- 14 seed stands
- 9 seed orchards (32 ha)
- More seed orchards coming

Advantages:

- Better quality
- Documented origin


Kilde: Gunnar Friis Proschowsky
Naturstyrelsen, Nordsjælland


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Seed borne fungi


Several fungi can be found on Nordmann fir seeds





Aspergillus



Trichothecium






Trichoderma

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Nordmann fir

But the two fungi that have attracted attention are

Neonectria neomacrospora



Sydowia polyspora

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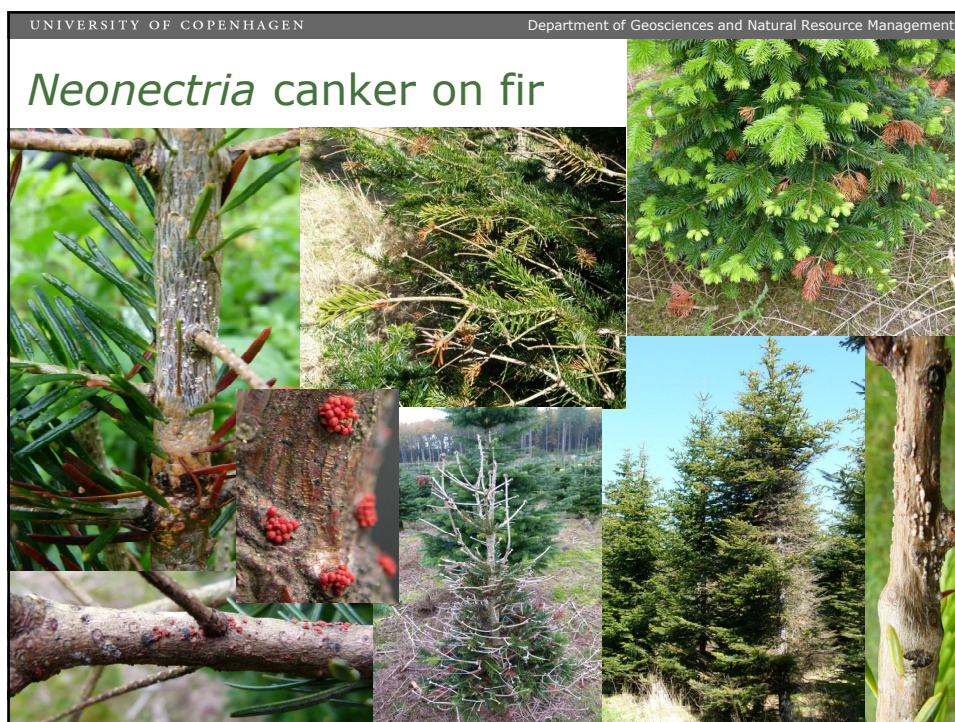
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The reason why

These two fungi cause diseases on nursery plants, Christmas trees, and older *Abies* sp.




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Neonectria symptoms on nordmann fir in Silkeborg Nordskov seed orchard 2011



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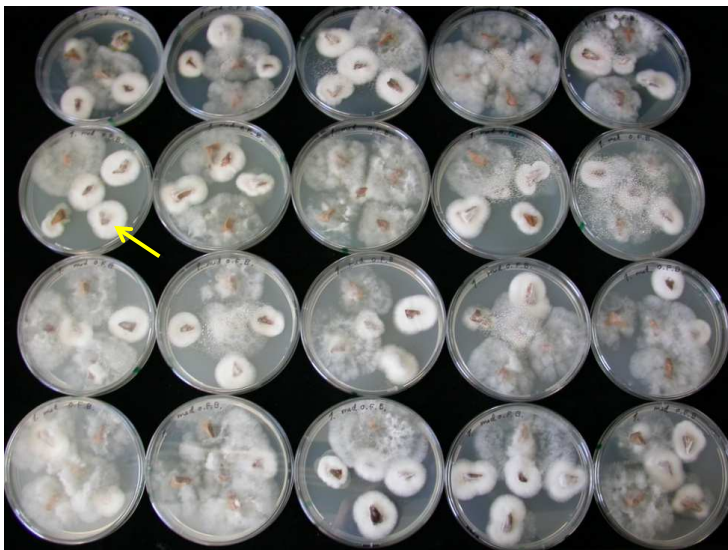
Heavy resin flow on cones from Nordmann fir with *Neonectria* infection



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Neonectria on seeds from infected cones
(the thick white mycelium)

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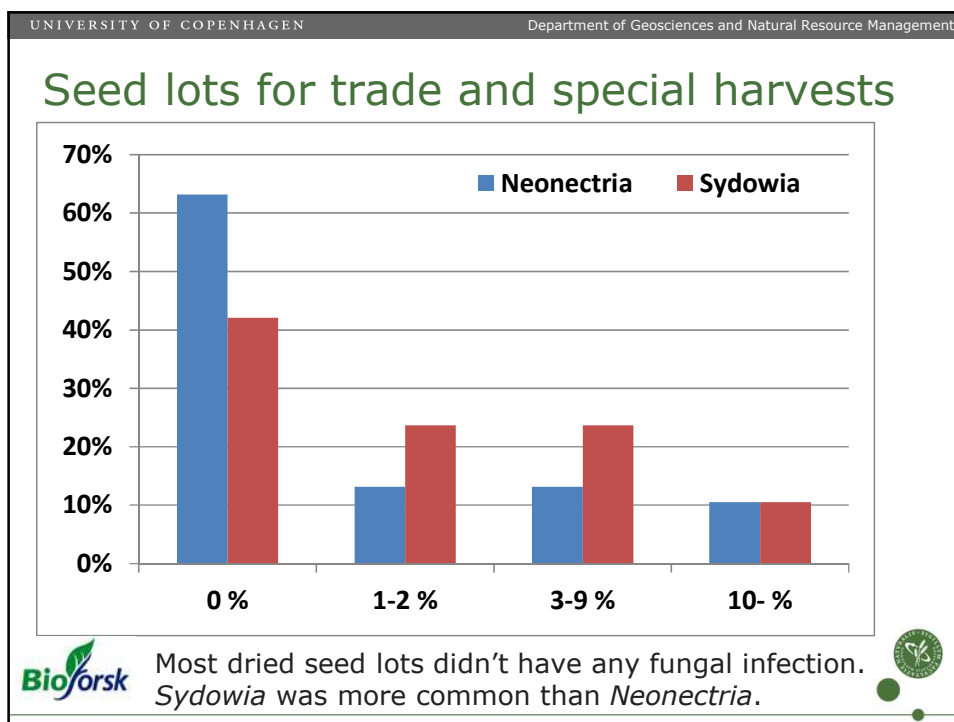
One sample of newly harvested seeds

100 seeds	<i>Neonectria</i>	<i>Sydowia</i>
Untreated	85	23
Surface sterilized	64	4



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Ie. the fungi are inside the seeds



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Importance of seed infection?

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Sydowia polyspora may reduce emergence of noble fir seed

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The fungus *Sydowia polyspora* is associated with two serious diseases on true fir (Abies spp.): current season needle necrosis (CSNN) and Sclerophoma shoot dieback. Both diseases are commonly observed in forest nurseries, and Christmas tree and lough plantations. Recently, we found that *S. polyspora* may reduce emergence in noble fir (*A. procera*).

Sydowia polyspora is frequently seedborne on conifers. We have detected *S. polyspora* on seeds from different species within seven conifer genera (Larix, Larix, Picea, Pinus, Pseudotsuga, Thuja and Taxus), including noble fir seeds. Prior to that, the fungus had only been reported to be seed borne on Scots pine (*Pinus sylvestris*).

Seed inoculation experiment
Possible influence of *S. polyspora* on the emergence of noble fir seeds (one seed lot) was studied in an inoculation experiment. Before sowing, the seeds were stratified for three weeks in moist filter with moist filter paper at 4°C in darkness. The experiment included the following treatments:

- Non-inoculated seeds (control)
- Stratified seeds soaked in spore suspension overnight (cellulose)
- Spore suspension sprayed on the seeds before stratification
- Spore suspension sprayed on the seeds at sowing

The seeds were sown in a soil sand mix (4:2) in 3 plastic trays (replicates) with 100 seeds per treatment and replicate. Position of all seeds was randomized within each tray. The trays were kept at 20°C, and they had transparent lids to let light through and keep humidity high the first 3 weeks.

Results and conclusion
Emergence percentage of seedlings was generally low. However, this is common with Abies seeds due to a thick seed coat, which makes it difficult to clean out empty seeds. The emergence, recorded in weeks after sowing, was significantly lower in the seeds that received fungal inoculum before stratification (11.1%) and seeds soaked overnight in spore suspension before sowing (13.2%), compared to the non-inoculated seeds (30.2%) and the seeds sprayed with spore suspension at sowing (40.2%). Our findings show that the presence of *S. polyspora* on seeds of noble fir may strongly reduce their emergence ability.

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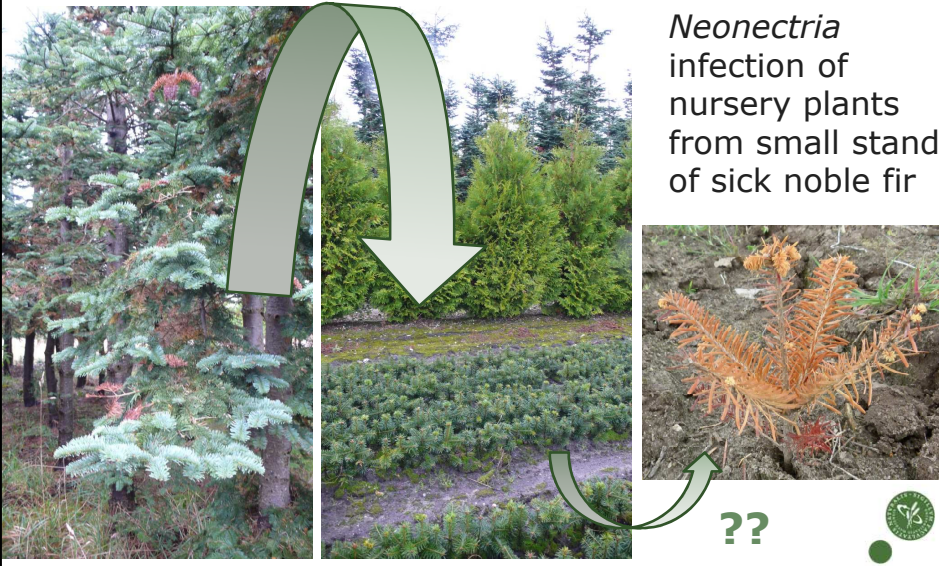
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Importance of local trees

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Neonectria infection of nursery plants from small stand of sick noble fir



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Local infection after planting

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Local infection after planting

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How to avoid seed infection?

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- Remove infection sources in seed orchards
- Seed treatment after harvest
- Fungicides after sowing
- Breeding for resistance



