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SOURCES OF HIGH CONCENTRATIONS OF *CLADOSPORIUM* SPORES IN THE AIR OF COPENHAGEN

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ABSTRACT

High counts of fungal spores in city air have been associated with respiratory allergies among the human population. The precise sources of such spores, in particular for episodes of the allergenic genera, *Cladosporium* and *Alternaria*, have been topics of scientific debate. Here we explore the hypothesis, that the cause of high concentrations *Cladosporium* spores can be attributed to the same physical mechanism that causes high *Alternaria* spore concentrations, i.e. emissions from distinct vegetation types followed by local or long distance transport. Additionally, we postulate that due to partial overlap of habitats for these fungi, there will be partial overlap with *Alternaria* spore concentrations during long distance transport (LDT) episodes. We suggest that the contribution to the overall load of *Cladosporium* is mainly local with intermittent long distance transport (LDT) from more remote areas. This hypothesis is tested by investigating a 10-year 3-hourly record of *Cladosporium* spores in the air of Copenhagen, Denmark. This record is based on volumetric observations with a spore trap of the Hirst design that has been made available from the Danish pollen and spore monitoring programme through Asthma-Allergy Denmark. The record contains a large number of clinically relevant episodes (daily average spore concentration above 3000 m^{-3}) with a distinct daily profile. Data analysis revealed potential LDT episodes almost every year. A source map combined with analysis of atmospheric transport suggests that LDT originates from the main agricultural areas in Central Europe or from major forests in the boreal region. A dedicated emission study during harvest of cereal crops 2010 and a grass seed crop in 2011 also supports our hypothesis. The emission study showed that the cereal fields that had been treated with fungicides produced large amounts of *Alternaria*, but low amounts of *Cladosporium* spores. In contrary, the grass seed harvest produced large amounts of *Cladosporium* spores. It is likely that such harvesting periods can cause clinically relevant levels of fungal spores in the atmosphere and our findings suggest that the same physical mechanism in the atmosphere can cause episodes with co-exposure of both *Cladosporium* and *Alternaria* when the source area is cropped agricultural fields, while woodlands in the boreal region tend only to produce large amounts of *Cladosporium* spores. It is evident that, with these insights, clinically relevant episodes of allergenic spore concentrations in city air could be simulated using atmospheric transport models.