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Structure of Wood-inhabiting Fungal Community in Relation to Quality of Decaying Norway Spruce Logs

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Aim

Dead wood and wood-decaying fungi are important in boreal forest ecosystems. However, the knowledge of habitat preferences of wood-inhabiting fungi is limited and mainly based on conspicuous fruit bodies.

We investigated succession and diversity of fungal community during decomposition of dead fallen logs by molecular analysis of fungal wood-inhabiting mycelium.

Material and Method

- Study sites (6) were natural or semi-natural Norway spruce dominated forests in Southern Finland.
- Fallen Norway spruce logs (591) ranging over all decay stages (classified to 1–5) were sampled by drilling saw-dust in the midway of each log.
- Communities of wood-inhabiting fungi were analyzed by direct DNA extraction and ITS1-PCR-DGGE profiling coupled with Sanger sequencing.
- Physico-chemical quality of wood substrate was determined by measuring length, diameter, moisture, density, ethanol and water extractives, Klason lignin and C/N ratio.

Results

NMDS ordinations of fungal communities in decaying logs

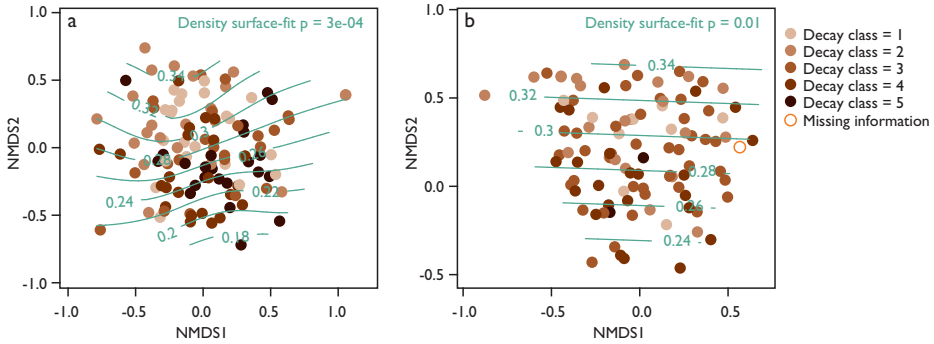

Fig. 1. Structure of fungal community, which was determined by DGGE profiling of rDNA ITS1, was related to the density of decaying wood. Two study sites (a, b) are shown for example but trend was similar in all study sites.

Fungal succession in decaying logs

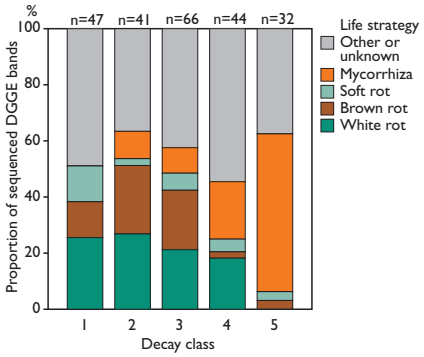

Fig. 3. White rot (*Phellinus viticola, P. nigrolimitatus, Trichaptum abietinum* etc.) and brown rot fungi (*Coniophora olivaceae, Antrodia serialis, Fomitopsis pinicola* etc.) inhabited slightly and intermediately decayed logs whereas mycorrhizal fungi (*Tylospora fibrillosa, Russula* sp., *Piloderma* sp. etc.) appeared already at decay stage 2 and dominated in heavily decayed logs.

Quality attributes of decaying logs as a function of density

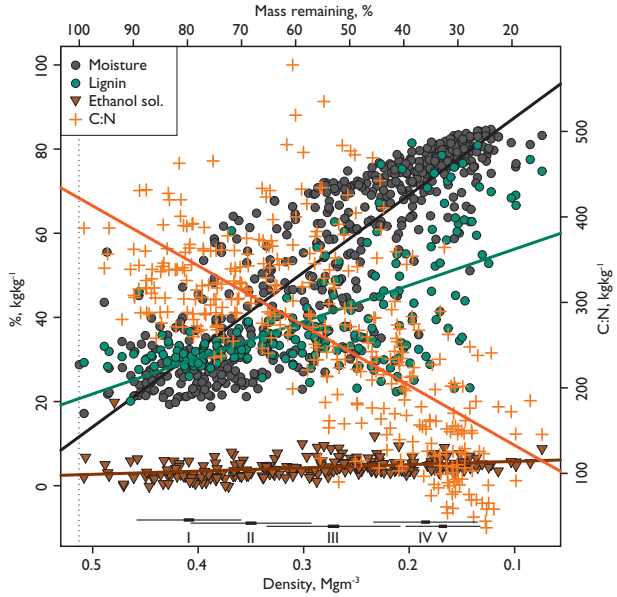

Fig. 2. Along with decreasing wood density, lignin and moisture content increased and C/N ratio decreased. Proportion of ethanol extractives did not change significantly with decay succession. Mean densities (+-SE) of logs in decay stages 1-5 are marked with short horizontal bold lines, +-SD are marked with horizontal thin lines.

Quality of decaying logs inhabited by fungi possessing different life strategies

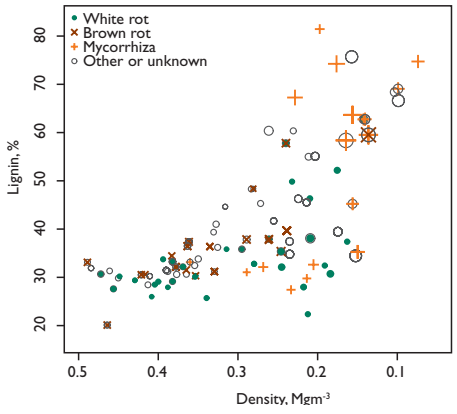

Fig. 4. Substrate preferences of white rot, brown rot and mycorrhizal fungi, which were identified by sequencing wood-inhabiting mycelia. Symbol size is related to N concentration of decaying wood. Appearance of white rot fungi was associated with small lignin-% (p=0.003) and small N concentration (p=0.014). Mycorrhizal fungi were mainly found in logs with small density.

Conclusions

Fungal community structure changed with wood decomposition and quality of wood substrate. Succession of fungal life strategy from lignin and cellulose decomposers to mycorrhizal fungi during wood decomposition was observed.

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