

Fungal community composition affects the rate of decomposition in *Picea abies* woody substrate

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Aims

Our aim was to apply culture-independent methods to study fungal community succession and combative interactions during the decomposition of Norway spruce wood at different decay stages. By performing a set of laboratory microcosms our attempts were to give answer to these questions:

1. Does dilution of fungal community remove less abundant fungi and does this affect to wood decomposition rate?
2. Does inhabiting-fungi of a specific wood decay stage adapt when they are introduced into a different woody substrate?
3. Do enzyme activities reflect changes in respiration activity?



Fig. 1. Sawdust samples were obtained from 48 fallen Norway spruce (*Picea abies*) logs from an unmanaged forest in Lapinjärvi (60°39.413'N, 26°7.352'E). Sample logs represented three decay classes: A) very decayed, B) medium decayed and C) recently decayed. Sawdust used as **inoculum** was prepared by drilling the discs with a flame-sterilized bit. Sawdust used as **substrate** was autoclaved twice (121 °C for 20 min) with a three-day interval.

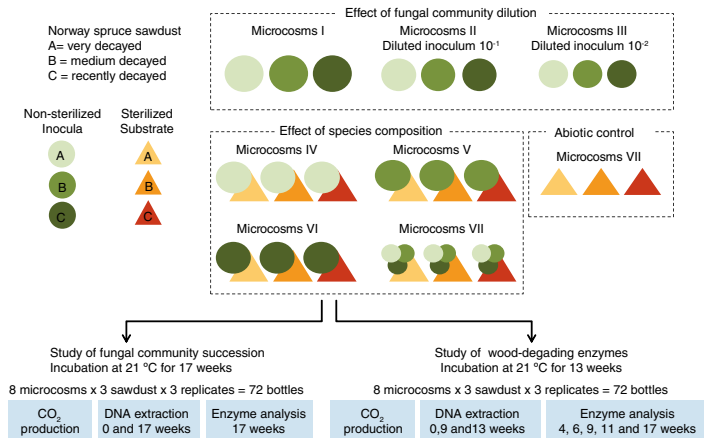


Fig. 2. Microcosms set-up The study of fungal community composition and diversity, and role of lignocellulose-degrading enzymes in Norway spruce decomposition was performed in a set of eight laboratory microcosms (I-VIII). Microcosms were performed in 100-ml glass flasks containing different amounts of inoculum and substrate and incubated at 21 °C in darkness for 13 or 17 weeks.



Fig. 3. Analyses: (1) Accumulated CO₂ by gas chromatography. (2) Recover of extracellular enzymes by centrifuging method. (3) Enzyme activity assays of four glycoside hydrolases (β-glucuronidase, β-xylosidase, β-glucosidase and cellobiohydrolase) by fluorimetric method. (4) Amplification of total fungal DNA with primer-pair ITS1F-GC and ITS2 and separation by DGGE.

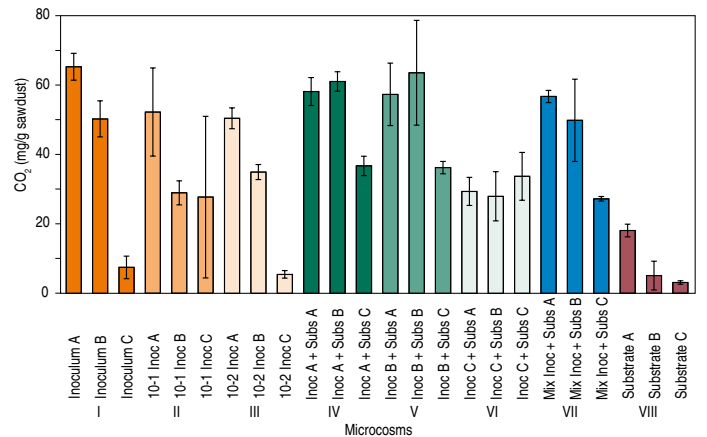


Fig. 4. CO₂ production decreased with wood quality being highest in heavily decayed inoculum (A) where number of fungal taxa is high. Diluted fungal diversity implied a slight decrease in CO₂ production during the incubation of moderately decayed wood (B). Heavily (A) and moderately decayed (B) sawdust inhabiting-fungi enhanced the degradation of the most recalcitrant sawdust (C). The combination of all fungal species (microcosm VII) was not detrimental for wood degradation process as compared with microcosms I.

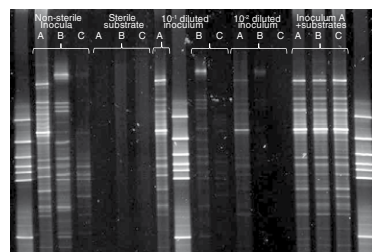


Fig. 5. DGGE indicated an increase of fungal diversity with decay. Dilution of inoculum decreased the number of DGGE bands and only the most abundant fungi prevailed after dilution.

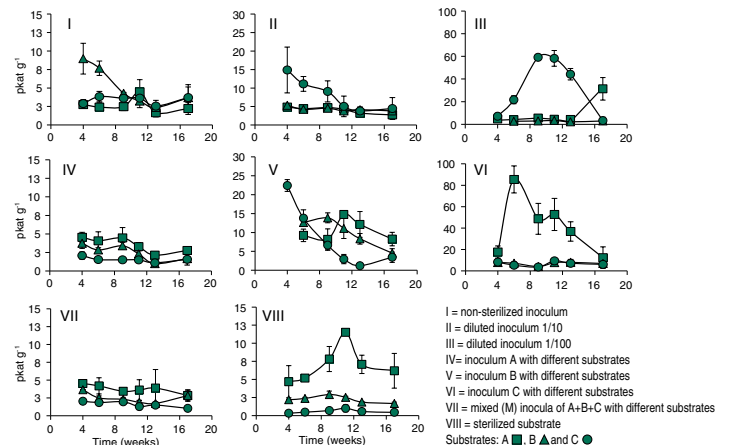


Fig. 6. The activity level of the hemicellulose-degrading enzyme β-glucuronidase was highest than that of the other hydrolytic enzymes. In general, maximum β-glucuronidase activities were measured at rather long incubation periods (6 or 9 weeks). The levels of β-xylosidase, cellobiohydrolase and β-glucosidase slightly changed during the 17-week of incubation (data not shown).

Conclusions

- DGGE analysis revealed that dilution of inocula only preserved the most abundant species. Reduction of fungal diversity had moderated consequences in CO₂ production.
- Fungal community composition had an effect on wood decomposition depending on wood quality and decay stage.
- High levels of enzyme activities did not reflect high respiratory activity.

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