EGU25-11830
EGU General Assembly 2025

The role of tree pollen in forest nitrogen cycling: A laboratory perspective

Ivan Limić[1], Samuel Bodé[2], Pascal Boeckx[2], Marijn Bauters[3], Johan Neirynck[4], Nicolas Bruffaerts[5], Stribor Marković[6], Elena Gottardini[7], and Arne Verstraeten[4]

[1]Institute for Adriatic Crops and Karst Reclamation, Department of Forestry, Split, Croatia
[2]Faculty of Bioscience Engineering, Department of Green Chemistry and Technology, Isotope Bioscience Laboratory (ISOFYS), Ghent University, Ghent, Belgium
[3]Faculty of Bioscience Engineering, Department of Environment, Q-ForestLab, Ghent University, Ghent, Belgium
[4]Research Institute for Nature and Forest (INBO), Geraardsbergen, Belgium
[5]Mycology and Aerobiology, Sciensano, Brussels, Belgium
[6]Faculty of biotechnology and drug development, Rijeka, Croatia
[7]Research and Innovation Centre, Fondazione Edmund Mach (FEM), San Michele all'Adige, Italy

Pollen is a critical component of the nitrogen (N) cycle in forests, but its role in N uptake, release and transformation during precipitation events remains poorly understood, contributing to uncertainties in N deposition estimates. In the frame of the COST Action CLEANFOREST a laboratory experiment was conducted to assess the biochemical activity of tree pollen and its effects on N compounds in precipitation. Pollen from green alder (*Alnus viridis*), pedunculate oak (*Quercus robur*), European beech (*Fagus sylvatica*), silver birch (*Betula pendula*), Scots pine (*Pinus sylvestris*) and Norway spruce (*Picea abies*) was suspended in a synthetic nitrate (NO_3^-) solution isotopically labelled with ^{15}N under non-sterilized conditions and two sterilization treatments: addition of (i) thymol and (ii) a broad-spectrum antibiotic mixture (PSA) containing penicillin, streptomycin, and amphotericin B. Over one week, water samples were analysed daily for NO_3^-, nitrite (NO_2^-), ammonium (NH_4^+) and total dissolved nitrogen (TDN) from which dissolved organic nitrogen (DON) was calculated. The results showed significant NO_3^- removal from the solution in broadleaved species, particularly oak, beech, and alder, in all treatments, but most clearly in the non-sterilized treatment. Most species showed a significant decrease in DON during the first two-three days, in all treatments, but especially in the sterilized (PSA) treatment, which was subsequently converted into NH_4^+ (mineralization). The use of ^{15}N as a tracer clearly shows that the labelled N was actively taken up by the pollen in both the non-sterilized and PSA-treated samples. Notably, pollen from all tree species, predominantly the broadleaves, enzymatically transformed extracellular NO_3^- into NO_2^-, highlighting its active role in the N cycle. These findings offer valuable insights into N release, uptake, and transformation during precipitation events and reveal important interactions between pollen and microorganisms. The differences observed between sterilized and non-sterilized treatments underline the significant influence of microbial activity on N conversion. By expanding our understanding of canopy-level N processes, this research contributes to improving N deposition models and introduces innovative approaches to studying the forest N cycle. Further studies are essential to clarify the mechanisms

by which pollen and microbial communities influence N transformations at ecosystem scales.

Keywords: Broadleaves; Conifers; Pollen; ^{15}N; Ammonium; Nitrate; Nitrite