

Influence of polyphenols on soil nitrogen mineralization through the formation of bound protein in tropical montane forests of Mount Kinabalu, Borneo

Abstract

We investigated the role of polyphenols in soil solution on N dynamics in tropical montane forests, in which soil N mineralization was typically low. We compared two sites on Mount Kinabalu, Borneo, which contrast in soil age (the Tertiary versus Quaternary period). The older site had a much thicker soil organic matter and reduced N availability. Soil solution was collected from twenty lysimeters that were installed at two depths (10 cm and 50 cm) at each of ten random locations at each site, and was fractionated into hydrophobic and hydrophilic fractions. The hydrophobic fraction was hydrolyzed to determine the concentration of bound N as amino acids. The mean concentration of phenolics was five times greater in soil solution of the upper horizon at the older N-poor site compared to the younger N-rich site. The mean concentration of hydrolyzed amino acids was twice greater in the upper horizon at the older N-poor site than that at the younger N-rich site; phenolics and amino acids were significantly greater under conifers than under non-conifers within the older site. DOC:DON ratio in soil solution was wider at the older N-poorer site (56) than at the younger N-richer site (34), reflecting the lower quality of litter for the former. We suggest that more protein-polyphenol complexes (PPC) in soil solution are formed at the older site and consequently the recalcitrance of N adds to the soil infertility. The dominance of conifer trees exacerbates the formation of PPC. © 2012 Elsevier Ltd.