# Water and carbon use of fine root in four tree species at the forest limit

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Tree fine roots are the primary organs for nutrient and water acquisition that is necessary for trees to survive. Trees growing at the forest limit are exposed to water stress because of drying, low temperature and soil freezing in winter. Water and carbon use strategies of fine roots may differ among tree species growing at the forest limit since it is suggested that differences in microbial-symbiosis and phylogenetic groups among tree species show a wide variation of root survival strategies. We aimed to examine the root water absorption and transport characteristics of four tree species at the forest limit (2,500 m altitude) on Mt. Norikura in Central Japan. The hydraulic conductivity, daytime water potential, respiration, morphology and anatomical traits of fine roots in deciduous broad-leaved species (*Sorbus commixta* and *Betula ermanii*) and evergreen needle-leaved species (*Abies mariesii* and *Pinus pumila*) were measured. The range of the root hydraulic conductivity was 1.17 to $4.02\times10^{-4}$ m $s^{-1}$ $MPa^{-1}$, which was significantly differed among species. In particular, *Pinus pumila* showed the highest hydraulic conductivity. The range of daytime root water potential was -0.20 to -0.12 MPa. Although there was no significant difference among species, the lowest daytime root water potential was observed in *Pinus pumila*. As a preliminary experiment, low root osmotic pressure at full turgor was estimated by pressure-volume curves in *Pinus pumila*. Therefore, the root of *Pinus pumila* might be able to absorb water actively by the low daytime water potential. We also discuss how root respiration, root morphology and anatomical traits are related to root water relations.

Keywords: water relations, fine root, hydraulic conductivity, daytime water potential, forest limit

 