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Fractionation of Nitrogen Isotopes by Plants with Different Types of Mycorrhiza in Mountain Tundra Ecosystems

Igor Buzin (1), Mikhail Makarov (1), Mikhail Maslov (1), and Alexei Tiunov (2)

(1) Soil Science Department, Moscow State University, Russian Federation, (2) AN Severtsov Institute of Ecology & Evolution RAE, Moscow, Russian Federation

We studied nitrogen concentration and nitrogen isotope composition in plants from four mountain tundra ecosystems in the Khibiny Mountains. The ecosystems consisted of a toposequence beginning with the shrub-lichen heath (SLH) on the ridge and upper slope, followed by the Betula nana dominated shrub heath (SH) on the middle slope, the cereal meadow (CM) on the lower slope and the sedge meadow (SM) at the bottom of the slope. The inorganic nitrogen concentration of the soils from the studied ecosystems were significantly different; the SLH soil was found to contain the minimum concentration of N-NH4+ and N-NO_3- , while in the soils of the meadow ecosystems these concentrations were much higher. The concentration of nitrogen in leaves of the dominant plant species in all of the ecosystems is directly connected with the concentration of inorganic nitrogen in the soils, regardless of the plant's mycorrhizal symbiosis type. However, such a correlation is not apparent in the case of plant roots, especially for plant roots with ectomycorrhiza and ericoid mycorrhiza. The majority of plant species with these types of mycorrhiza in the SH and particularly in the CM were enriched in 15N in comparison with the SLH (such plants were not found within the SM). This could be due to several reasons: 1) the decreasing role of mycorrhiza in nitrogen consumption and therefore in the fractionation of isotopes in the relatively-N-enriched ecosystems; 2) the use of relatively-15N-enriched forms of nitrogen for plant nutrition in meadow ecosystems. This heavier nitrogen isotope composition in plant roots with ectomycorrhiza and ericoid mycorrhiza in ecosystems with available nitrogen enriched soils doesn't correspond to the classical idea of mycorrhiza decreasing participation in nitrogen plant nutrition. The analysis of the isotope composition of separate labile forms of nitrogen makes it possible to explain the phenomenon. Not all arbuscular mycorrhizal species within the sedge meadow were 15N-enriched in comparison with other ecosystems. This could either be explained by the different role of mycorrhiza in nitrogen plant nutrition of different arbuscular mycorrhizal plant species or by the primary usage of various nitrogen compounds with different levels of 15N concentration in individual plant species.
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