Visible-near infrared spectral reflectance explains variations in fine root traits of woody species

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The visible and near infrared spectroscopic information can provide powerful tools for identifying and quantifying chemical substances of soil, fruit and leaf, yet less is known about characteristics of reflectance spectroscopy for tree fine roots. In this study, we aimed to examine the effects of tree species on the reflectance of fine roots and to determine the association of the reflectance with respect to morphological, anatomical and chemical traits of fine roots of 20 species. We sampled fine roots in a cool temperate forest in Japan. The fine roots were divided into three diameter classes (0-0.5 mm, 0.5-1.0 mm, 1.0-2.0 mm). We obtained hyperspectral reflectance images at 458-2391 nm (total 376 bands by 4.1-5.8 nm interval) for fresh intact fine root for each three diameter classes. The relationships of reflectance images with average root diameter (mm), specific root length (m g^{-1}), root tissue density (g cm^{-3}), stele: cortex ratio, and carbon and nitrogen concentration (%) as each root trait were analyzed at each specific wavelength. The spectral patterns of the fresh intact root systems showed peak at four wavelength band across all woody species. Spectral reflectances at 458-1400nm were positively related to the root diameter. On the other hand, the reflectances differ among tree species. We will examine relationship the reflectance and root traits which characterized tree species. These results indicate that spectral reflectance at visible-near infrared regions can be an important determinant of species specificity of fine root traits by even fresh intact samples.

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