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Soil microbial biomass, community level physiological profiles relate to tree species and its state in urban environment

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Urban trees and soil microbial communities are the key ecosystem components to provide the supporting, provisioning and regulating services that define citizen's well-being. Understanding the relationships between physiological states, age, species of trees and microbial functional properties are needed for a management of urban areas and landscapes' engineering. The research focuses on finding linkages between a wide range of trees' properties monitored by smart TreeTalker technology and soil functional microbial indexes in Moscow megapolis.

The study was carried out on the RUDN University campus area (Moscow, Russia), where six tree species were selected (Pinus sylvestris, Populus tremula, Acer platanoides, Tilia cordata, Picea abies, Betula pendula). TreeTalker device was installed on the preselected five trees of each species for monitoring the sap flux, vertical stability (according to digital accelerometer), spectrums of canopy reflectance, trunk and canopy air temperature and humidity. Monitoring started in May 2019. The composite soil samples (0-10) were taken under each tree at the 0.5 m distance from its stand by augering in October 2019. In the samples, the microbial biomass carbon (MBC, SIR-method), basal respiration (BR), community level physiological profile (CLPP, MicroResp) and Shannon microbial diversity index (H') based on CLPP were determined.

Soil MBC content was significantly depended on tree species, increasing from A.platanoides to T.cordata (from 538 to 1445 μg C g^{-1}). The microbial diversity index was lowest in soil under A.platanoides (H'=2.1) and the highest for B.pendula (H'=2.4). The soil CLPP for A.platanoides was mainly shifted to microbial response on carboxylic acids with the low reaction on amino and phenolic acids compared to other trees species (e.g. B.pendula). Soil qCO_2 (BR/MBC ratio) was positively related to trees' age (r=0.8). Response to carboxylic acids (especially oxalic) had the highest correlation with physiological properties of the trees: trunk moisture, photochemical reflectance index and vertical stability (r > -0.5).

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