Geophysical Research Abstracts
Vol. 17, EGU2015-4823, 2015
EGU General Assembly 2015

Plant- versus microbial signature in densimetric fractions of mediterranean forest soils: a study by thermochemolysis gas chromatography mass spectrometry

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The ageing of a given organic substrate decomposing in soil is strongly dependant of its microbial utilization and transformation (reworking) by the soil microflora. How far a given substrate or soil fraction has gone in this evolution is usually measured by means of molecular signatures, ratios between organic compounds which enlighten us about the origin and/or the degree of microbial reworking of a specific group of compounds: lipids, proteins, lignin, carbohydrates, etc. Owing to the biochemical heterogeneity of decomposing substrates it is unlikely that the degree of microbial reworking can be approached with a single signature. Applying a couple of them is much better, but obtaining a wide collection of molecular signatures can be time consuming. Here, instead of applying specific methods to obtain a collection of specific signatures, we apply TMAH-thermochemolysis to obtain a panoramic view of the biochemical composition of a series of densimetric fractions of soils. From the compounds identified after TMAH-thermochemolysis, a collection of indicators was obtained: (a) ratio between short and long-chained linear alkanoic acids; (b) ratio between branched and long-chained linear alkanoic acids; (c) ratio between C16 and total alpha-omega-alkanedioic acids; (d) ratio microbial to plant-derived 1-methoxyalkanes; (e) ratio syringyl to total lignin-derived phenolic compounds; (f) vanillic acid to vanillin ratio; (g) fucose/glucose ratio; and (h) xylose/glucose ratio. From these indicators a single numerical value is distilled, allowing to order a couple of densimetric fractions of soil organic matter according to its degree of microbial reworking. This approach was applied to the comparison of a couple of densimetric fractions of soil organic matter of three organic H horizons from mediterranean forest soils. Fractions were obtained by a sequential extraction with sodium polytungstate (NaPT) at density 1.6, 1.8 and 2.0, after ultrasonic disintegration of the sample. Before ultrasonic treatment, a previous extraction was done with NaPT d = 1.6, to isolate the free light fraction. Results were overall consistent in the sense that occluded fractions of density <1.8, and particularly those of density < 1.6, appear as the most microbially evolved. The free light fraction was overall the most fresh-, least evolved fraction. The dense fraction (d > 2.0), made of organomineral complexes with fine silt plus clay, was overall fresh and poorly microbially reworked. Our future work will be the application of this approach to the study of complete soil profiles and soil fractions, thus allowing to obtain a panoramic view of the stabilization of soil organic matter at different depths.