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Changes in soil organic matter after 5-year field experiment of rainfall exclusion and increased temperature in a Mediterranean savannah

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Mediterranean savannahs (dehesas) are typical agro-sylvo-pastoral systems, characterized by the scattered presence of oak trees (*Quercus ilex, Quercus suber*), and the integration of livestock, forest, and agricultural practices. These Mediterranean ecosystems are subjected to a marked seasonality that imposes a sever summer drought after a favourable rainy autumn and spring, that is reflected in soil microbial dynamics. Under such conditions, the relative importance of a-biotic constraints such as temperature warming, irreversible dehydration favoured by intense solar radiation and drastic drying cycles, are important factors in soil organic matter (SOM) dynamics and the formation of stable forms in soil. The interplay of driving factors on the microbial dynamics - climate, vegetation and soil is key to understand biogeochemical cycles in Mediterranean forests that, in-turn is expected to be reflected in SOM structure.

In this communication analytical pyrolysis coupled with gas chromatography-mass spectrometry (Py-GC/MS) was used for the molecular characterization of SOM in a field manipulative experiment of rainfall exclusion and increased temperature aimed to evaluate the impact of forecasted warming and drying. The experimental trial is located in Sierra Morena (Pozoblanco, Córdoba, SW-Spain). Composite soil samples (0-10 cm) were taken from four forced climatic treatment plots: warming (W); drought (D); combination of both (W+D); untreated control (C). The plots were installed in 2016 under two distinct habitats: evergreen oak canopy ('tree') and in the open pasture ('open'). Data presented correspond to sampling conducted in 2017 (a year after the installation of field trials) and five years later in 2021.

A total of 116 compounds were identified, and composition differences were detected between 'tree' and 'open' habitats both in 2017 and 2021, for the main compound classes: nitrogen compounds (N), aromatics (ARO), lignin methoxyphenols (LIG), isoprenoids (ISO), fatty acids (FA), lipids (LIP) and polysaccharide-derived (PS). Such chemical differences were found to be derived from the biomass composition of the predominant vegetation type incorporated into the soil. The FA and LIP (*n*-alkanes) were found most responsive to climatic treatments, showing less abundance under D and W plots. This trend is more pronounced in 'open' habitat and remains

significant after 5 years of experiment. Moreover, the proportion between PS and LIG moieties increased over time especially in the 'tree' habitat, with a preferential degradation of PS due to increasing microbial activity. Finally, the proportion of ARO and short and mid-chain LIP increased during the trial, pointing to non-favourable SOM decomposition conditions.

Here, a short-term field experiment indicates that Mediterranean dehesa soils can buffer climate change effects over time. The results suggest that SOM molecular composition encompasses information on soil environmental shifts having biomarker value for monitoring climate change in Mediterranean soils. The technique can also help to monitor SOM turnover rates attending to the progressive transformation of different compound families.

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