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Drought-resistant fungi control soil organic matter decomposition and its response to temperature

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Microbial-mediated decomposition of soil organic matter (SOM) ultimately makes a considerable contribution to soil respiration, which is typically the main source of CO2 arising from terrestrial ecosystems. Despite this central role in the decomposition of SOM, few studies have been conducted on how climate change may affect the soil microbial community and, furthermore, on how possible climate-change induced alterations in the ecology of microbial communities may affect soil CO2 emissions. Here we present the results of a seasonal study on soil microbial community structure, SOM decomposition and its temperature sensitivity in two representative Mediterranean ecosystems where precipitation/throughfall exclusion has taken place during the last 10 years. Bacterial and fungal diversity was estimated using the terminal restriction fragment length polymorphism (TRFLP) technique. Our results show that fungal diversity was less sensitive to seasonal changes in moisture, temperature and plant activity than bacterial diversity. On the other hand, fungal communities showed the ability to dynamically adapt throughout the seasons. Fungi also coped better with the 10 years of precipitation/throughfall exclusion compared to bacteria. The high resistance of fungal diversity to changes with respect to bacteria may open the controversy as to whether future “drier conditions” for Mediterranean regions might favor fungal dominated microbial communities. Finally, our results indicate that the fungal community exerted a strong influence over the temporal and spatial variability of SOM decomposition and its sensitivity to temperature. The results, therefore, highlight the important role of fungi in the decomposition of terrestrial SOM, especially under the harsh environmental conditions of Mediterranean ecosystems, for which models predict even drier conditions in the future.