Impact of *Quercus ilex* Dieback on the Composition of Biogenic Volatile Organic Compounds in a Mediterranean Forest

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Climate change is impairing tree physiology and growth, causing an increase in tree dieback in many Mediterranean forests. Mediterranean vegetation is known for emitting substantial amounts of Biogenic Volatile Organic Compounds (BVOCs), with their emission and biosynthesis being highly sensitive to environmental conditions. These compounds have a key antioxidant function for plant tissues, thus improving ozone and drought tolerance, while also acting as pollinator attractors and repellents for dangerous herbivorous insects (contributing to the taste and odour of different plants). Our study applied a fast and easy-to-handle analytical methodology to sample BVOCs using solidphase microextraction (SPME) fibres at the canopy level. An improvement of BVOCs adsorption from SPME fibres was obtained by coupling the fibres with fans to create a dynamic sampling system (DBSS) and the results obtained showed high efficiency and sensitivity of SPME fibres, reducing sampling time. These DBSS devices were used to seasonally monitor the changes in BVOC emission of a *Quercus ilex* L. (holm oak) coastal forest in Southern Tuscany (Maremma Regional Park, Grosseto, Italy). In particular, we evaluated the BVOC emissions and the relationship with the changes in understory species composition in two forest stands characterized by different levels of holm oak crown defoliation (low and high defoliation, LD and HD) over three years. We found significant changes in the understory plant community following holm oak decline, observing an increment in the number of shrubs both in HD and LD stands. The environmental sampling of BVOCs fully reflected the changes in vegetation cover and composition in the two stands, with a reduction in the amount of monoterpene emissions due to the increasing rates of defoliation and mortality of the dominant species. Our results suggest that terpene emissions from Mediterranean forests would be modified by an increase of *Q. ilex* dieback, with important consequences for the functioning of this forest ecosystem. This study will be further implemented in the next five years through the LIFE RECLOAK project, aimed at studying the metabolomics changes induced in *Q. ilex* trees by drought and the pathogen *Phytophthora cinnamomi* in their natural environment.

Keywords: Biogenic Volatile Organic Compounds (BVOCs), drought, *Quercus ilex* L., Mediterranean forests, SPME fibres.