Implication of plants, fungi, and bacteria in the oxalate-carbonate pathway in non calcareous soil.

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Plants, fungi, and bacteria enhance the oxalate-carbonate cycle in soils. Moreover, in temperate forests, it is related to mineral nutrient cycles including Ca and other elements such as Fe, Al and P (Cromack et al., 1977). Plants and fungi produce large amounts of calcium oxalate that are consumed by oxalotrophic bacteria as carbon and energy sources. So, the complete oxidation of oxalate salts releases carbonate and hydrogenocarbonate ions in the soil environment with a concomitant alkalinisation of the soil solution. If calcium is available, these conditions lead to the precipitation of secondary calcium carbonate (Braissant et al., 2004; Cailleau et al., 2005; Cailleau et al., 2004). Half of the organic carbon from oxalate is released as carbon dioxide into the atmosphere, the other half is transformed into mineral carbon (Verrecchia et al., 2006) with a residence time 10 to 100 longer than organic carbon (Retallack, 1990). Because salts are originally organic, the oxalate-carbonate pathway represents a potential major carbon sink (Cailleau et al., 2005) and probably acts as a regulator of the atmospheric pCO2 (Verrecchia et al., 2006). In acidic soils, the precipitation of calcium carbonate allows an improvement of pedological conditions in terms of fertility and biodiversity.
The aim of this study is to better understand the dynamics of abiotic and biotic interactions between soil, oxalogenic plant and fungi, and oxalotrophic bacteria as well as their consequences on the structure and functioning of soil. The African oxalogenic trees Milicia excelsa and Afzelia africana and the invasive cactus from Salina (Italy) *Opuntia sp.* were selected to study the oxalate-carbonate pathway in non calcareous soil. Ferralsols of Burkina Faso have a pH of 4-5, but microcrystalline calcite is found in the rhizosphere of *Milicia excelsa* and *Afzelia africana* where the pH could reach values of 8-9. On Salina Island, oxalate crystals and calcite are observed at the soil surface under decaying Opuntia leaves. These soils do not contain primary calcite and the exogenous contribution does not explain the secondary precipitation.

Chemical and microbiological methods were performed to define the biotic and abiotic soil conditions necessary for calcite precipitation. The soil parameters as well as the cultivable fungal soil community were investigated to understand their relative role in the calcium oxalate-carbonate pathway in soils and to identify their potential relationships with oxalotrophic bacteria in microcosms.

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