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Fungal role in the movement, leaching and deposition of minerals across leaf litter and soil

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A considerable number of fungi have been described as having the power to translocate nutrients, but little is known about this role in the leaf litter-soil interface food web. A technique for evaluating the mechanisms of cellulose colonization by fungi and the changes in elemental composition of cellulose during its exploitation was set up. Ten sheets of pure cellulose (cotton linter) filter paper (10cm2) were layered to form a pad which was then inserted into a square-shaped terylene netting bag (15cm2), with a mesh size of 1mm2 . This package was then incubated for 6 months under leaf litter originating from an area of a low mixed Mediterranean maquis located in southern Italy (408570N; 138550E). Four different sites as field replicates were considered along three sampling times. The analysis of cellulose sheets by means of Scanning electron microscopy and EDS (Energy Dispersive X-ray spectroscopy) after 45, 180 and 600 days of field incubation has provided evidence of a progressive increase in the fragmentation of the niche represented by the cellulose itself in the course of proceeding of the decomposition. A clear change occurred in the content of trace elements during decomposition: two groups of elements were observed that seemed to have behaved differently over time. A larger group whose average concentration has been increasing with field incubation time was composed by Si, Fe, Al K, Cl, Mg. A second group of three elements (Ca, P and S) instead has followed a very different trend, increasing in some cases significantly and almost logarithmically between the first and the second sampling, and then remaining constant or even decreased (as in the case of Ca) between the second and the third sampling. The first group of microelements is clearly linked to the contribution of the soil (sandy), while the elements of the second group appeared correlated to biological activity. During the decomposition of cellulose Ca enters into fungal enzymatic mechanisms related to the tricarboxylic acid cycle (i.e. accumulation or precipitation of calcium oxalate in the environment); this can explain the peculiar behaviour of this element across the incubation time. The P and S are biogenic elements that enter directly in the composition of proteins and nucleic acids and other fundamental biological molecules (ATP , co-enzymes, structural proteins), and could be associated to the extent of fungal colonisation of cellulosic material. The results of the study provided evidence of a functional role of fungal hyphae and rhizomorphs in the movement, leaching and deposition of minerals across soil and leaf litter layers. (417 words)