

Metabolic responses of microbial community in soil amended with fresh leaves and leaf extracts from eucalyptus spp.

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Abstract

Field observations reveal that often large areas of soil surface beneath *Eucalyptus occidentalis* Endl. are completely bare or with scant vegetation. Moreover, previous studies have showed that other species of Eucalyptus, such as *Eucalyptus camaldulensis* Dehn, may be effective in suppressing seed germination and weed growth. Such effects have been ascribed to the large number of secondary metabolites within Eucalyptus leaves. Due to their inhibition activity against weeds, leaf extracts might be used for an integrated weed management context, in accordance with the Directive 2009/128/EC. Several studies exist about the effects of Eucalyptus leaf extracts on weeds, whereas they are lacking on soil microorganisms. Therefore, the aim of this study was to assess the effects of Eucalyptus leaf extracts on soil microbial biomass and activity, as well as on the relative abundance of main microbial groups. The extracts were obtained by hydrodistillation [essential oils (EOs) and hydrolates] and by water cold extraction (aqueous extracts) from leaves of both *E. camaldulensis* and *E. occidentalis*. Also, fresh leaves were tested. The soil was spread with EOs at doses of 2.64 or 3.52 $\mu\text{l g}^{-1}$. They were applied by adding a proper water solution containing the given amount of EOs to 350 g of dry soil, so reaching 50% of its water holding capacity. The above solution held the emulsifier Fitoil at 0.5 mL L⁻¹. Fresh leaves, dried at 40°C for 48 hours, were chopped and applied at doses of 6.6 and 5.0 mg g⁻¹ of dry soil for *E. camaldulensis* and *E. occidentalis*, respectively. Such litter application doses were those found, at field conditions (780 and 575 g m⁻², respectively). Two controls were also prepared: one with water and another with water and Fitoil. After the addition of all the treatments, soils were incubated at room temperature (20-23°C) in the dark for 35 days. At days 7 and 35, soils were analyzed for soil microbial biomass C and N. At the same days, the main microbial groups were investigated through the ester linked fatty acids (FAMES). Moreover, 20 g of soil were incubated as above in 200 mL jars to determine the soil respiration rate (CO₂ emission) during 36 days of incubation. Preliminary results showed, that EOs from the two species and at both doses exerted a significant biocidal action on soil microorganisms, while hydrolates, aqueous extracts and fresh leaves stimulated both microbial biomass and activity.