

Soil bioindicators and weed emergence as affected by essential oils extracted from leaves of three different Eucalyptus species

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The widespread use of synthetic herbicides has resulted in herbicide-resistant weeds, altered ecological balance and negative effects on human health. To overcome these problems, efforts are being made to reduce the reliance on synthetic herbicides and shift to natural products. Essential oils (EOs) extracted from plants have been demonstrated to have potential herbicide activity. EOs, composed by volatile organic compounds and characterized by a strong odor, are used in the cosmetic, pharmaceutical and food industries as they are thought to be safe compounds for humans, animals, and the environment. EOs extracted from Eucalyptus leaves have antimicrobial, antiviral, fungicidal, insecticidal, anti-inflammatory, anti-nociceptive and anti-oxidant effects. Moreover, *in vitro* studies have demonstrated that they have inhibitory effects on germination of seeds of many crops and weeds.

The aim of this work was to evaluate the *in vivo* effects of EOs extracted from Eucalyptus leaves on both weed emergence and biochemical soil properties. Furthermore, since the diverse species of Eucalyptus have shown to have different biological activities, EOs were extracted from three Eucalyptus species (*E. camaldulensis*, *E. globulus*, *E. occidentalis*). Fresh leaves were collected from an afforested area near Piazza Armerina (province of Enna, Italy) and their EOs extracted by hydrodistillation. Soil samples were collected from the topsoil (<5 cm) of an Inceptisol within the experimental farm of the University of Palermo, air-dried and sieved at 1 cm. Five hundred grams of this soil were filled in each of 20 aluminum pots (10×20 cm). The soil samples were brought up to 100% of the water holding capacity (WHC) by adding 150 mL of tap water, followed by 70 mL of tap water containing 8 mL L⁻¹ of one of the three extracted EOs. This experimental test was repeated for remaining two EOs. Fitoil was used as emulsifier at a concentration of 0.1% (v/v). The control consisted of the soil treated as the EO treatment but with Fitoil only. The soils were incubated in greenhouse conditions. After 2 days, the 100% WHC halved and then it was kept to this level (50% WHC) by watering soil daily. The experiment was carried out in quadruplicate. After one month the soil were brought up to 100% of WHC, plant biomass and height of germinated weeds and soil biochemical properties were evaluated. This work reports the results and discuss them.