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Phytotoxicity of volatile oil from *Eucalyptus citriodora* against some weedy species

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Abstract: *A study was undertaken to explore the phytotoxicity of volatile essential oil from Eucalyptus citriodora Hook. against some weeds viz. Bidens pilosa, Amaranthus viridis, Rumex nepalensis, and Leucaena leucocephala in order to assess its herbicidal activity. Dose-response studies conducted under laboratory conditions revealed that eucalypt oils (in concentration ranging from 0.0012 to 0.06 %) greatly suppress the germination and seedling height of test weeds. At 0.06 % eucalypt oil concentration, none of the seed of test weeds germinated. Among the weed species tested, A. viridis was found to be the most sensitive and its germination was completed inhibited even at 0.03%. Not only the germination and seedling growth, even the chlorophyll content and respiratory activity in leaves of emerged seedlings were severely affected. In A. viridis chlorophyll content and respiratory activity were reduced by over 51% and 71%, respectively, even at a very low concentration of 0.06%. These results indicated an adverse effect of eucalypt oils on the photosynthetic and energy metabolism of the test weeds. A strong negative correlation was observed between the observed effect and the concentration of eucalypt oil. Based on the study, it can be concluded that oil from E. citriodora possess strong inhibitory potential against weeds that could be exploited for weed management.*

Key words: *Bioherbicides, Chlorophyll content, Dose-response studies, Respiratory activity, Seedling growth, Weed management*

Introduction

Weeds are unwanted and undesirable plants that interfere with utilization of land and water resources and thus, adversely affect human welfare. In croplands and forests, weeds compete with desired and beneficial vegetation, reducing the yield and quality of produce. Global economic losses due to weeds are enormous and a huge amount of money is spent to control them (Zimdahl, 1999). Though the control of weeds can be achieved by several methods, yet the use of synthetic herbicides is quite common and effective. Unfortunately, the indiscriminate use of synthetic herbicides during the last three decades has resulted in various toxicological effects on the environment and living organisms including humans. Moreover, their continuous use has resulted in evolution of new weed biotypes with herbicidal resistance. To overcome these problems, efforts are being made world over to find out alternative means, which are not only eco-friendly but, also cost effective and bioefficaceous. In this direction, screening of natural plant products depicting herbicidal and pesticidal potential has gained momentum since they are not only biodegradable and possess novel molecular target sites but also have diverse chemical nature with no or less halogen atoms and heavy metals (Dayan *et al.*, 1999; Duke *et al.*, 2002).

Among the natural plant products, volatile essential oils-the constituents of aromatic plants, are known to possess relatively high phytotoxicity (Singh *et al.*, 2003) and degrade quickly in the environment (Beuchat, 2001). Terpenoids, particularly monoterpenes and sesquiterpenes, are the main components of essential oils and are responsible for the inhibitory activity of these oils. *Eucalyptus* (family Myrtaceae) species are well-known for their essential oils that find profuse use in medicines, perfumery and as flavouring agents. Among various species, lemon-scented eucalypt (*Eucalyptus citriodora* Hook.) is well-known for its antimicrobial (Dellacassa *et al.*, 1989), antifungal (Ramezani *et al.*, 2002), insecticidal (Isman, 2000), and nematicidal (Pandey *et al.*, 2000) activities. Singh and Kohli (1992) reported that plantations of *E. citriodora* have very little vegetation under their canopy and around them and it is due to the release of oil vapours from the trees, which move downwards and affect the adjoining vegetation. However, little has been done to further explore their phytotoxic potential against weeds. Therefore, the present investigation was undertaken to assess the phytotoxicity of eucalypt oil against some weeds with a view to explore them as a bioherbicide for weed management.

Materials and Methods

Extraction of oil: Eucalypt oil was extracted using Clevenger apparatus from healthy and mature freshly collected leaves of lemon-scented eucalypt *(Eucalyptus citriodora* Hook.) trees of nearly 25 year age growing in Botanical Garden, Panjab University, Chandigarh, India. Leaves (250g) were chopped and mixed with 1 liter distilled water in a 2 liter round bottom flask and fitted with condenser. The mixture was boiled for 3hr and oil was collected from the nozzle of the condenser, dried under sodium sulphate and stored at 4 °C for further use.

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