

Phytotoxicity of the Volatile Monoterpene Citronellal against Some Weeds

Harminder Pal Singh^{a,*}, Daizy R. Batish^b, Shalinder Kaur^b, Ravinder K. Kohli^{a,b}, and Komal Arora^b

^a Centre for Environment and Vocational Studies, Department of Botany, Panjab University, Chandigarh 160014, India. E-mail: hpsingh_01@yahoo.com

^b Department of Botany, Panjab University, Chandigarh 160 014, India

* Author for correspondence and reprint requests

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A study was undertaken to assess the phytotoxicity of citronellal, an oxygenated monoterpene with an aldehyde group, towards some weedy species [*Ageratum conyzoides* L., *Chenopodium album* L., *Parthenium hysterophorus* L., *Malvastrum coromandelianum* (L.), Garcke, *Cassia occidentalis* L. and *Phalaris minor* Retz.]. A significant effect on weed emergence and early seedling growth was observed in a dose-response based laboratory bioassay in a sand culture. Emergence of all test weeds was completely inhibited at 100 µg/g sand content of citronellal. Seeds of *A. conyzoides* and *P. hysterophorus* failed to emerge even at 50 µg/g content. Root length was inhibited more compared to shoot length. The failure of root growth was attributed to the effect of citronellal on the mitotic activity of growing root tips cells as ascertained by the onion root tip bioassay. At 2.5 mM treatment of citronellal, mitosis was completely suppressed and at higher concentrations cells showed various degrees of distortion and were even enucleated. The post-emergent application of citronellal also caused visible injury in the form of chlorosis and necrosis, leading to wilting and even death of test weeds. Among the test weeds, the effect was severe on *C. album* and *P. hysterophorus*. There was loss of chlorophyll pigment and reduction in cellular respiration upon citronellal treatment indicating the impairment of photosynthetic and respiratory metabolism. Scanning electron microscopic studies in *C. occidentalis* leaves upon treatment of citronellal revealed disruption of cuticular wax, clogging of stomata and shrinkage of epidermal cells at many places. There was a rapid electrolyte leakage in the leaf tissue upon exposure to citronellal during the initial few hours. In *P. minor* electrolyte leakage in response to 2 mM citronellal was closer to the maximum leakage that was obtained upon boiling the tissue. The rapid ion leakage is indicative of the severe effect of citronellal on the membrane structure and loss of membrane integrity. In all, the study concludes that citronellal causes a severe phytotoxicity on the weeds.

Key words: Post-Emergent Herbicidal Activity, Mitotic Inhibitor, Membrane Integrity