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Effects of acute ozone exposure on the release of stress volatiles, and the expression of a monoterpene synthase gene in *Nicotiana tabacum* leaves through recovery

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Ozone is a phytotoxic compound often encountered at increased levels in the atmosphere. However, the immediate and longer-term impact of ozone exposure on plant volatile release is poorly understood. Tobacco (*Nicotiana tabacum* cv. Wisconsin) leaves were exposed to acute ozone doses of 0 (control), 400, 600, 800, and 1000 ppb for 30 min and we studied the effects of ozone exposure on ozone uptake, gas exchange properties, emission of lipoxygenase pathway (LOX) volatiles, mono- and sesquiterpenes, and expression of a monoterpene synthase. Foliage net assimilation rate and stomatal conductance to water vapor were curbed with the severity of ozone exposure. Ozone exposure enhanced emissions of LOX volatiles dominated by hexanal, and also altered the emission blend of foliage monoterpenes dominated by limonene and foliage sesquiterpenes dominated by α -caryophyllene compared with control leaves. A relative expression of a monoterpene synthase gene, camphene synthase, was downregulated immediately after exposure to 400, 600, and 800 ppb ozone but it was upregulated at 1000 ppb of ozone. A time-delay analysis of camphene synthase gene expression and product emission indicated that with a 3-hour delay, the emissions and gene expression were highly correlated, suggesting that there was a time-lag of at least 3 h from signal transduction and gene expression to formation of the terpene synthase protein. This study reveals foliage emission of LOX in response to acute ozone exposure was quantitatively related to the severity of ozone exposure. However, the stress dose vs. emission relationship was not observed for mono- and sesquiterpene emissions. There was a time-delay of minimum 3 h from signal transduction to formation of the terpene synthase protein for monoterpene synthases but further studies are needed to gain insight into how TPS genes are regulated upon acute ozone stress.

Biography

Arooran Kanagendran is pursuing his PhD in Plant Eco-Physiology at the Estonian University of Life Sciences, Estonia under the supervision of Professor Ülo Niinemets. His main research interests are in terpene molecular biology and emission in higher plants. He did his Master's in Molecular Biology at the University of Hertfordshire, UK.

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