Methyl jasmonate elicits distinctive hydrolyzable tannin, flavonoid, and phyto-oxylipin responses in pomegranate (*Punica granatum* L.) leaves

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Abstract

Methyl jasmonate (MeJA) produced in plants can mediate their response to environmental stresses. Exogenous application of MeJA has also shown to activate signaling pathways and induce phytoalexin accumulation in many plant species. To understand how pomegranate plants respond biochemically to environmental stresses, metabolite analysis was conducted in pomegranate leaves subjected to MeJA application and revealed unique changes in hydrolyzable tannins, flavonoids, and phyto-oxylipins. Additionally, transcriptome and real-time qPCR analyses of mock- and MeJA-treated pomegranate leaves identified differentially expressed metabolic genes and transcription factors that are potentially involved in the control of hydrolyzable tannin, flavonoid, and phyto-oxylipin pathways. Molecular, biochemical, and bioinformatic characterization of the only lipoxygenase with sustained, MeJA-induced expression showed that it is capable of oxidizing polyunsaturated fatty acids, though not located in the subcellular compartment where non-jasmonate (non-JA) phyto-oxylipins were produced. These results collectively suggested that while the broad suppression of flavonoids and anthocyanins is at least partially controlled at the transcriptional level, the induced biosynthesis of non-JA phyto-oxylipins is likely not regulated transcriptionally. Overall, a better understanding of how pomegranate leaves respond to environmental stresses will not only promote plant health and productivity, but also have an impact on human health as fruits produced by pomegranate plants are a rich source of nutritional compounds.