

Exogenous methyl jasmonate prevents necrosis caused by mechanical wounding and increases terpenoid biosynthesis in *Panax ginseng*

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Abstract Upon mechanical wounding, plants locally induce necrosis, accumulate methyl jasmonate (MeJA) and acquire systemic resistance in nearby tissues. One-month-old in vitro grown *Panax ginseng* seedlings were treated with either 50 μ M MeJA or mechanical wounding alone or a combination of both, to evaluate jasmonic acid (JA) signaling and terpene biosynthetic pathway genes along with terpenoid accumulation. After MeJA treatment, JA pathway genes, such as lipoxygenase (*PgLOX*), hydrogen peroxidase lyase (*PgHPL*), allene oxide synthase (*PgAOS*), and allene oxide cyclase (*PgAOC1*), and terpene pathway genes, such as isopentenyl diphosphate isomerase (*PgIPP*) and farnesyl diphosphate synthase (*PgFPS*), were highly expressed and resulted in the accumulation of mono- and sesquiterpenes. During mechanical wounding, *PgLOX* expression was induced relatively late after 72 h of

treatment, however *PgAOC1* was not induced. This resulted in decreased production of MeJA that in turn may have lowered terpenoid production. In contrast, wounding + MeJA treatment increased *PgAOC1* and *PgLOX* gene expression earlier after 6 h and slowly promoted the production of mono- and sesquiterpenes. Furthermore, we monitored the effect of MeJA upon wounding in in vitro grown 1-month-old seedlings treated with MeJA + wounding. These results demonstrated that exogenous MeJA is able to promote recovery from the wounding effect by functioning as a long distance signal. Additionally, these results suggest that exogenous MeJA supplied at the time of mechanical wounding prevents necrosis in the ginseng leaves by increasing the production of terpenoids.

Keywords Allene oxide cyclase · Lipoxygenase · Long signaling molecules · Monoterpenes · Sesquiterpenes

Abbreviations

JA	Jasmonic acid
MeJA	Methyl jasmonate
OGA	Oligogalacturonides
WR	Wound responsive
IPPI	Isopentenyl diphosphate isomerase
DMAPP	Dimethylallyl diphosphate
GPP	Geranyl diphosphate
FPS	Farnesyl diphosphate synthase
LOX	Lipoxygenase
HPL	Hydrogen peroxidase lyase
AOC	Allene oxide cyclase
AOS	Allene oxide synthase
GC–MS	Gas chromatography mass spectrometry
RT-PCR	Reverse transcription PCR
qRT-PCR	Quantitative real time-reverse transcriptase polymerase chain reaction

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