The anticipation of danger: microbe-associated molecular pattern perception enhances AtPep-triggered oxidative burst

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The endogenous Arabidopsis (Arabidopsis thaliana) peptides, AtPeps, elicit an innate immune response reminiscent of pattern-triggered immunity. Detection of various danger signals, including microbe-associated molecular patterns (MAMPs), leads to elevated transcription of PROPEPs, the AtPep precursors, and PEPRs, the AtPep receptors. It has been hypothesized that AtPeps are involved in enhancing pattern-triggered immunity. Following this idea, we analyzed the relationship between MAMP- and AtPep-elicited signaling. We found that the perception of MAMPs enhanced a subsequent AtPep-triggered production of reactive oxygen species (ROS). Intriguingly, other components of AtPep-triggered immunity like Ca(2+) influx, mitogen-activated protein kinase phosphorylation, ethylene production, and expression of early defense genes, as well as ROS-activated genes, remained unchanged. By contrast, treatment with methyl jasmonate promoted an increase of all analyzed AtPep-triggered responses. We positively correlated the intensities of generic AtPep-triggered responses with the abundance of the two AtPep receptors by generating constitutively expressing PEPR1 and PEPR2 transgenic lines and by analyzing pepr1 and pepr2 mutants. Further, we show that enhanced, as well as basal, ROS production triggered by AtPeps is absent in the double mutant of the respiratory burst oxidase homologs D and F (rbohD rbohF). We present evidence that the enhancement of AtPep-triggered ROS is not based on changes in the ROS detoxification machinery and is independent of mitogen-activated protein kinase and Ca(2+) signaling pathways. Taken together, these results indicate an additional level of regulation besides receptor abundance for the RbohD/RbohF-dependent production of AtPep-elicited ROS, which is specifically operated by MAMP-triggered pathways.

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