

특강1 Expression of cucumber matrix metalloproteinase gene at the boundary of senescence and programmed cell death

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Cell-cell and extracellular cell matrix (ECM) interactions provide cells with information essential for controlling morphogenesis, cell-fate specification and cell death. In animals, one of the major enzymes that degrade ECM are the matrix metalloproteinases (MMPs). Here, we report the characterisation of the cucumber *Cs1-MMP* gene encoding such an enzyme likely to play a role in plant ECM degradation. *Cs1-MMP* has all the hallmark motifs characteristics of animal MMPs and is a pre-pro-enzyme having a signal peptide, propeptide and zinc-binding catalytic domains. *Cs1-MMP* also displays some functional similarities with animal MMPs for example, it has a collagenase-like activity which can cleave synthetic peptides and it can degrade collagen type I, a major component of animal ECM. *Cs1-MMP* activity is completely inhibited by a hydroxamate-based inhibitor which binds at the active site of MMPs in a stereospecific manner. Finally, the *Cs1-MMP* gene is expressed *de novo* at the end stage of developmental senescence, prior to the appearance of DNA laddering in cucumber cotyledons, leaves and male flowers. Additionally our results suggest that senescence cell death is one process comprising two different phases, one corresponding to senescence per se, and the other corresponding to PCD. As the steady-state level of *Cs1-MMP* mRNA peaks late in senescence and the pro-enzyme must undergo maturation and activation, the protease is probably not involved in nutrient remobilisation during senescence but may have another function. The physiological substrates for *Cs1-MMP* remains to be determined but the enzyme represents a good candidate for plant ECM degradation and may be involved in PCD.

Keywords: cell death, cotyledon, cucumber, *Cucumis sativus*, matrix metalloproteinase, senescence