Title The involvement of LX ribonuclease and programmed cell death in flower and leaf abscission

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Abstract

Abscission occurs specifically in the abscission zone (AZ) tissue, as a natural stage of plant development in which leaves, flowers or fruits separate from the mother plant. Abscission has a large agricultural implication during plants' growth, as well as during storage and shelf life of the fresh produce. In many ornamentals separation of organs from the parent plant can be accelerated during postharvest life, resulting in a pronounced loss of quality. In our research we investigated the involvement of the LX ribonuclease and programmed cell death (PCD) in the abscission process of flowers and leaves, using tomato (*Lycopersicon esculentum* Mill.) as a model system. Our results show that the tomato *LX* gene, known to be induced during ethylene-mediated responses, senescence and PCD, was also induced specifically in the AZ at a late stage of the abscission process. Accordingly, a marked delay of flower and leaf abscission was observed in the generated *LX*-inhibited transgenic tomato plants, in which the LX protein level was reduced. The known association between *LX* expression and PCD suggests involvement of PCD in abscission. Indeed, hallmarks of PCD were identified in the tomato flower and leaf AZs during the late stage of organ abscission. These included loss of cell viability, altered nuclear morphology, DNA fragmentation, elevated levels of reactive oxygen species, and elevated enzymatic activities and expression of PCD-associated proteins and genes, respectively. Our analysis also indicated that different abscission-related processes occur asymmetrically between the AZ proximal and distal sides, which may be of functional significance. This research may establish a new biotechnological approach for modulating abscission in agriculturally important ornamentals, and may have broad applications in different other crops, in which abscission has an agricultural relevance.