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Role of Phospholipases in Wound Signal Transduction of Plants

이수민*, 김세주, 최복희, 이영숙
포항공대 생명과학과

Plant defense systems are activated upon exposure to pathogens or physical wounding by herbivores. Lipids and lipid metabolites have previously been implicated in these defense responses. Activation of phospholipases, which generate lipid metabolites important in the defense response, was measured in response to physical wounding. The first leaves of tomato or broad bean seedlings at 2 leaf stages were wounded and production of lipid metabolites was measured in the wounded leaf and in a second non-wounded leaf. In the wounded leaf, phosphatidic acid increased approximately 4 fold within 5 min whereas the lysophospholipids, lyso-phosphatidylcholine and lysophosphatidylethanolamine, increased over 2 fold within 15 min of wounding. Similar changes in these lipids were observed in the second non-wounded leaf. Our results suggest that the wound signal is propagated to the outside of the wounded leaf within 5 min in these plants, and it activates phospholipases, which can produce some important precursors of defense molecules or second messengers in wound signal transduction in plants. (Supported by a grant from Korea Ministry of Education)

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Microfilaments Regulates Stomatal Movements via Modulating K^+ Channel Currents in Guard Cells

은순옥*, 황재웅, 김문정, 하권수[1], 이영숙
포항공대 생명과학과, [1]기초과학 연구지원센터

Stomatal movements involve pronounced changes in the shape and volume of the guard cell. We tested if the changes are regulated by actin microfilaments (MFs). Immunolocalization on fixed cells and microinjection of phalloidin-FITC into live guard cells of *Commelina communis* L. showed that cortical MFs were radially distributed fanning out from the stomatal pore site. The actin antagonists phalloidin (PH), which binds to and thus stabilizes MFs, and cytochalasin D (CD), which depolymerizes MF, showed distinctly different, often opposite effects on MF organization, stomatal movements and K^+ channel activities. Treatment of epidermal peels with PH prior to stabilizing MFs with m-maleimidobenzoyl N-hydroxysuccimimide caused dense packing of radial MFs and an accumulation of actin around many organelles. Both stomatal closing induced by ABA and opening under light were inhibited. Treatment of guard cells with CD abolished the radial pattern of MFs, generated sparse, poorly oriented arrays, and caused partial opening of dark closed stomata. The opening effect of CD is likely to be mediated by its effects on voltage-dependent K^+ channels in plasma membrane of guard cells; CD enhanced inward K^+ channel activity and decreased the outward K^+ channel activity. In contrast, PH inhibited the inward K^+ channel activity. These results suggest that MFs participate in stomatal aperture regulation via regulating ion channel activities in guard cells.