LIGHT MICROSCOPE AND ULTRASTRUCUTRAL OBSERVATIONS OF PETIOLE ABSCISSION IN COTTON

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Abstract

Abscission is an important physiological process that limits yield and indirectly affects fiber quality in cotton. The purpose of this study was to determine the structural changes contributing to petiole abscission in cotton. Ethephon (2-choroethyl1-phosphonic acid) hastened cotyledonary leaf abscission of cotton, *Gossypium hirsutum* L. 'Deltapine'. Abscission of the cotyledonary petioles was induced in explants prepared from 14-day-old seedlings by removal of the leaf blade, and then applying either lanolin or lanolin containing 0.1% ethephon to the cut ends of the petioles. Prominent swelling of collenchyma cells on the adaxial side of the petiole within the abscission zone provided the first morphological indication that the abscission process had begun in explants treated with either lanolin or lanolin + ethephon. Separation occurred immediately distal to this region of swollen cells and was initiated first on the adaxial side of the petiole. Enlargement or swelling of ground tissue cells also was observed on the abaxial side of the petiole in some experiments. Xylem parenchyma cells also appeared swollen. Tyloses were observed within vessel elements of xylem tissue of the petiole proximal to the region where cell separation was observed. Ultrastructural changes in abscission zone cells of the explants treated with ethephon occurred earlier than those of the lanolin treatment. Vesicles of varying size, mostly surrounded by a unit membrane, appeared within the mid-cell wall regions as cell separation progressed in both lanolin and ethephon treated tissues. Free cell wall microfibrils also accumulated at this time. Middle lamella dissolution and partial degradation of the primary cell wall resulted in cell separation in the abscission zone before the petiole stump abscised from the explant. The plasma membrane of most separation layer cells remained intact following cell wall degradation and these intact cells contained degraded chloroplasts and mitochondria. A few separation layer cells broke down completely, and the organelles within them became embedded in the degraded cell wall matrix. Although ethephon treatment hastens the abscission process, no other differences in structural events leading up to abscission were observed when tissues of ethephon-treated explants were compared to lanolin-treated (control) explants. These anatomical and ultrastructural changes suggest that abscission specific, cell wall hydrolytic enzymes are being secreted following stimulation of abscission by leaf blade removal. Parallel studies of gene expression associated with abscission in cotton are underway to identify gene products principally contributing to these structural changes induced by ethephon.

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