Rapid root abscission phenomenon in the water fern Azolla pinnata

Form 3

論 文 要 旨

Abstract

論文題目

Title **Rapid root abscission phenomenon in the water fern *Azolla pinnata***

(アカウキクサの根脱離現象に関する生理学的研究)

Azolla pinnata is a small water fern that can be found in tropical and subtropical regions worldwide. A phenomenon referred as to "rapid root abscission" is one of the prominent characteristics unique to *Azolla*. This physiological plant response is defined as rapid root detachment from fronds under stress conditions. Until recently, the mechanism has remained unknown; how the plant senses a wide variety of environmental stimuli to induce the rapid root abscission response. A major objective of this study was to explore an early chemical event of the rapid root abscission phenomenon initiated by chemical inducers. The polyamines (PAs) spermine and spermidine were found to initiate the root abscission. Their degradation products 1, 3-diaminopropane, ß-alanine and hydrogen peroxide (H_2O_2) all failed to initiate the root abscission, suggesting that spermine and spermidine are new chemical inducers. We investigated effects of various chemicals on the root abscission initiated by different types of chemical inducers. PA-induced root abscission was partially suppressed by the reduced form of glutathione (GSH) and also by the sulfhydryl-specific reagent *S*-methyl methanethiosulfonate (MMTS). Nitrite (NO_2^-)-induced abscission was found to be inhibited by the nitrate reductase inhibitor sodium tungstate (Na_2WO_4) but potassium chlorate ($KClO_3$) was not effective. GSH and MMTS significantly suppressed the nitrite-induced root abscission. Sodium azide (NaN_3) was the most effective in the initiation of the abscission among the chemical inducers tested. Unlike the abscission induced by PAs and nitrite, MMTS was less effective in the inhibition of the azide-induced abscission. We found that *A. pinnata* emitted NO into the air when NaN_3 was added. The NO producing activity was strongly inhibited by potassium cyanide (KCN) or the catalase inhibitor 3-aminotriazole. These results suggest that thiol modification is involved in the initiation process of the root abscission. A novel mechanism for sensing multiple environmental stimuli is discussed in terms of a possible interaction between functional thiol group(s) and reactive nitrogen species that is potentially produced in stressful conditions.

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