Disease Resistance and Drought Tolerance of *Kalmia latifolia* Induced by Endophytic Actinomycetes©

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An isolate of endophytic actinomycetes, designated AOK-30, was selected as a candidate for further studies from 73 isolates obtained from field-growing mountain laurel (*Kalmia latifolia* L.) based on growth test on the multiplication tissue culture medium and antimicrobial activity. This isolate was identified as *Streptomyces padanus* based on morphological, physiological, cultural characters, and nucleotide sequences of 16S rDNA. It was tolerant to almost all of routinely used agrochemicals.

Application of mycelial suspension of AOK-30 to the medium surface in flasks where tissue-cultured seedlings were growing successfully induced their resistance to *Pestalotia* disease. Direct soil mixing of the suspension or powdered bean curd with the AOK-30 culture successfully protected transplanted seedlings from *Pestalotiopsis* and *Rhizoctonia* diseases.

Tissue-cultured seedlings turned reddish within 7–10 days after treatment with AOK-30. Osmotic pressure of protoplasts prepared from these seedlings was greater than that of protoplasts from AOK-30-untreated green seedlings. Use of cellulase successfully released protoplasts from the untreated green seedlings, while cellulase and xylanase were required for the release from AOK-30-treated reddish seedlings. These results suggested that cell wall components of AOK-30-treated seedlings could be different from those of untreated green seedlings. Sugar analyses revealed that hemicellulose such as arabinose and callose in reddish seedlings remarkably increased in contents. A further protein analysis of cell wall fraction of reddish seedlings showed the increase of a specific protein showing 100% homology with potato malate dehydrogenase that is supposed to be associated with lignification. The subsequent histochemical test proved that lignification of cell walls was accelerated in reddish seedlings, especially in sieve elements surrounding the vascular system. These results suggested that a high osmotic pressure in cells and chemical modifications of cell walls could be associated with enhanced water retention and thus drought tolerance of AOK-30-treated seedlings.