Mechanism of salt tolerance in salt-adapted winged bean cultured cells

Muneharu Esaka (Faculty of Applied Biological Science, Hiroshima University)
Mikio Nishimura (National Institute for Basic Biology)
Yoshiyuki Tanaka (National Institute of Agrobiological Resources)
Masayoshi Maeshima (Graduate School of Bioagricultural Sciences, Nagoya University)

Summary

Cultivated land is becoming progressively polluted by salt, and this salinization presents a major problem for the future of agriculture. Therefore, much attention has recently been focused on mechanisms of salt tolerance in higher plants. Winged bean, a tropical plant with the ability to withstand heat and drought, has attracted special interest as a high protein and oil food source of the humid tropics.

Winged bean callus was adapted to increasing concentrations of NaCl by sequential transfer to medium with 0, 0.5, 1.0, 1.5 or 2.0% (w/v) NaCl. When the culture media after cell suspension cultures of the salt-adapted callus were analyzed by SDS-polyacrylamide gel electrophoresis, six specific polypeptide bands named SAP1, SAP2, SAP3, SAP4, SAP5 and SAP6 were observed. When the amino-terminal amino acid sequence of SAP1 was determined, 10 and 5 of the amino-terminal 32 amino acid residues were found to be hydroxyproline and proline, respectively. SAP1 on an acrylamide gel was stained by the periodic acid-Schiff method. Thus, SAP1 was suggested to be hydroxyproline-rich glycoprotein, which is known to be localized in cell wall. The amino-terminal amino acid sequences of SAP2, SAP4, SAP5 and SAP6 were homologous to the sequences of proline-rich proteins. These results suggest that cell wall proteins may play some role in salt tolerance of winged bean cells. On the other hand, the amino-terminal amino acid sequence of SAP3 was homologous to the sequences of basic class I chitinases, a kind of pathogen related proteins. It is very interesting how the chitinase takes part in salt tolerance.

SAP1 was abundantly secreted in suspension cultures of winged bean cells adapted to 1.0 and 1.5% NaCl. The SAP1 yield was about 4 mg/g cells fresh weights. SAP1 was secreted also in the presence of $AlCl_3$, but little was secreted in the presence of KCl, LiCl, $CaCl_2$, $MgCl_2$, mannitol or sucrose.

Further studies are now required to clarify molecular mechanism of salt torelance of salt-adapted winged bean cells.