Title A quantitative and qualitative analysis of antioxidant enzymes in relation to susceptibility of apples to superficial scald.

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Abstract

The activities and isoenzyme patterns of guaiacol-dependent peroxidase (POX), ascorbate peroxidase [L-ascorbate peroxidase] (APX), superoxide dismutase (SOD) and catalase (CAT) were studied in yellow- and red-fruited crab apple (*Malus*) selections from a 'White Angel' x 'Rome Beauty' cross that show differential susceptibility to the physiological storage disorder superficial scald (which develops during prolonged cold storage and is thought to be a chilling injury). There were no consistent relationships between total enzyme activities and scald incidence, high activities of the enzymes being detected in selections with both high and low susceptibilities to scald. However, additional individual isoforms of some antioxidant enzymes were detected in the scald-resistant selections when compared with scald-susceptible selections. In a native gel system, four guaiacol-dependent POX isoenzymes were detected in both yellow and red scald-resistant selections compared with only two in scald-susceptible selections. Similarly, for anodic acidic POX assayed using benzidine, six isoenzymes were detected in both yellow and red scald-resistant selections compared with five in yellow and four in red susceptible selections. Ten SOD isozymes were detected in scald-resistant yellow-fruited selections compared with only five faint bands in scald-susceptible selections, but similar patterns were not detectable for red-fruited selections. Differences in the presence of various isoenzymes for CAT and APX were also detected among the selections, but associations with scald susceptibility were also affected by fruit colour or were inconsistent. The presence or absence of individual isoenzymes may be a better indication of scald resistance or susceptibility than the total enzyme activities. Isoenzyme analyses, especially of POX, could be useful to breeders for the early detection of scald resistance/susceptibility in apples.