

Cadmium- and Flood-Induced Anoxia Stress in Pea Roots Measured by Electrical Impedance

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Electrical impedance measurement – complex resistance in the presence of alternating current – is a useful tool for the investigation of structural characteristics of solid materials but also for plant tissues. This measurement is easily done: only two electrodes are inserted into the plant tissue, so it can be considered as a non-invasive technique and it may be a successful method for detecting structural changes in plants caused by environmental stresses. The effects of flood and cadmium stress were investigated by electrical impedance measurement, because both of them cause structural changes in plant tissues. Apoplasmic resistance (R_a), symplasmic resistance (R_s), and membrane capacitance (C_m) of pea roots were calculated. In the first five days of flood treatment, the R_s and C_m values of roots decreased drastically. In case of cadmium treatment, the R_s and C_m values of roots showed an increasing tendency supposedly as a consequence of the enhanced membrane rigidity, the thickened cell walls and decreased growth phenomena caused by the heavy metal. There also was a remarkable difference in cadmium accumulation patterns and in the changes of the calculated parameters amongst anoxic and aerated seedlings. This initial work revealed that the development of stress caused by two environmental stress agents, cadmium and flood, can be followed by electrical impedance measurement.

Key words: Cadmium, Electrical Impedance Spectroscopy