Bacteria-Root Cell Interaction During Primary Stages of Wheat Root Colonization by *Azospirillum brasilense* Cd

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Association between beneficial bacteria of the genus *Azospirillum* and various cereals may improve plant growth and yield. Adsorption of a major part of the applied *A. brasilense* Cd population by soil particles followed the inoculation of wheat roots as well as another phenomenon of non-specific migration of bcteria in soil were detected. Bacterial migration was significantly stimulated by various wheat cultivars and by synthetic attractants. After reaching the target plant, bacterial multiplication took place and two modes of bacterial binding to the roots were observed. Aggregates of bacterial cells attached weakly to the outer surfaces of root epidermal cells and to the root-hairs and bacterial cells within the cortex. Washing the roots removed most of the external but not the internal bacteria. Killing the bacteria, either before their interaction with the roots, or afterwards, eliminated the bacteria from the root surfaces. This adsorption of *Azospirillum* to wheat roots can be defined as a weak, active, metabolic process.

Immunogold labeling of *A. brasilense* Cd revealed bacteria in intercellular spaces of the cortex as far as the endodermis layer.Bacteria were neither detected in the endodermis nor in the vascular system of wheat. Additionally, Live *A. brasilense* Cd cells were also found inside root cells without any apparent damage to the plant and to the bacterial cells. The bacteria were bound to the cell walls in the cortex intercellular spaces as well as to the epidermal cells by an electron dense material. This type of colonization revealed an unharmful inter- and intracellular association between bacteria and wheat roots, in addition to root outer surface colonization.

Proton extrusion from roots of young wheat plants that were grown in the presence of ammonium and absence of ferrous ions was significantly enhanced after inoculation. This enhancement was more prominant in young inoculated plants than in older ones and may be associated with mineral uptake in the plant at later stages of the inoculation process. It is concluded that several phenomena, involving mutual recognition factors and membrane excitation, participate in the primary stages of this interaction.

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