MULTICELLULAR GROWTH AND MIGRATION OF BACILLUS CEREUS IN SOIL

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ABSTRACT

*Bacillus*, primarily members of the *B. cereus* group are bacteria readily isolated from a wide range of soils. Analysis of the genome of *B. cereus* ATCC 14579 supports the current paradigm that it is a saprophyte, growing in proteinaceous environments such as the guts of invertebrates. By contrast the high numbers found in soil are believed to occur as resting spores. We hypothesized that *B. cereus* is able to grow in soil, and therefore studied its soil-associated behavior. Growth was studied in filter sterilized liquid Soil Extracted Solubilized Organic Matter (SESOM)(pH 6.5) and in artificial soil microcosms. Cultures were studied by fluorescence microscopy using BacLight and DAPI to observe morphology in soil conditions. Fluorescently labeled lectins were used to identify sugars in extracellular polymers. *B. cereus* was able to germinate, grow and subsequently sporulate, both in liquid SESOM and in the soil microcosms. Cells grew as long chains with thick N-acetyl glucosamine (NAG) and galactose-containing bridges between them. Filaments coalesced to form large clumps with most cells sporulating. Spores were retained in an extracellular matrix containing DNA as revealed by both extracellular fluorescence (DAPI) and DNase treatment. The switch to multicellularity, reminiscent of the related *B. mycoides*, was not observed when grown in rich medium such as LB broth. The mycoidal phenotype may be due to incomplete hydrolysis of the septal peptidoglycan as supported by intercellular NAG. Mycoidal structures formed as a response to growth in soil served to traverse gaps between soil particles and so dissemiate the species in the soil environment.