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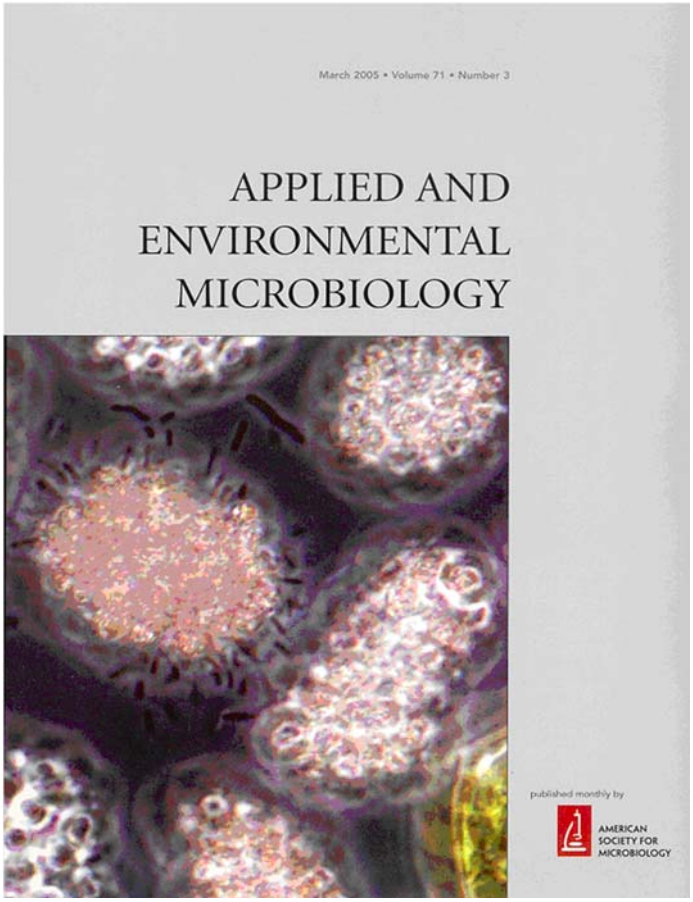

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Y. Wang and J. R. Leadbetter. 2005. Rapid Acyl-Homoserine Lactone Quorum Signal Biodegradation in Diverse Soils. ***Applied and Environmental Microbiology*** *71(3): 1291-1299.*

Quorum sensing, a cell density dependent gene regulation process, is used by many bacteria to coordinate certain activities. This process allows bacteria to express certain genes only after they reach a high enough population density for that activity to be effective or useful. Many important soil bacteria, such as *Rhizobium*, *Agrobacterium*, *Burkholderia*, and *Pseudomonas*, use acyl-homoserine lactones (acyl-HSLs) as dedicated signal molecules in quorum sensing controlled gene expression. These soil bacteria use quorum sensing to regulate the production of secondary metabolites in soils that impact agriculturally important processes, such as the bio-control of fungi, plant pathogenesis, and soil aggregation.

Recently, research has shown that many soil microbes can rapidly degrade acyl-HSLs in laboratory culture medium, thus reducing signal accumulation and quorum sensing. Acyl-HSLs are biodegraded in soils sampled from diverse U.S. sites and by termite hindgut contents. Heating or irradiation of the soil eliminated the mineralization, but protein synthesis inhibitors did not, which suggests extracellular soil enzymes may be effective in this process. It would take chemical lactonolysis months to match the level of signal decay achieved in only a few days by biological activity in a turf soil sample. The quorum-sensing systems of soil bacteria may already be tuned to meet the challenge of signal decay. However, biological signal degradation must be considered when designing or interpreting studies to examine microbial cell-cell communications and quorum sensing-controlled processes in species-rich environments, such as soils.

Soil bacteria tend to exist in microcolonies that are isolated based on dynamic soil processes and varying water contents. In addition to disrupting the quorum sensing process, rapid decay of acyl-HSLs might serve to quiet signal cross talk that could otherwise occur between spatially separated microbial aggregates. This insulation of microbial aggregates from extraneous signals could preserve and even accentuate the spatial and chemical heterogeneity as well as the biological microstructure of these complex microbial ecosystems. Thus, biological signal decay might either promote or complicate cellular communications and the accuracy of population density-based controls on gene expression in species-rich ecosystems. This research will broaden our understanding of how microbial ecosystem function within a complex soil structure and will ultimately lead to increased soil productivity.

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