

Is there a role for ice nucleation activity in bacterial dissemination?

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Our scientific understanding of microbes started with species deions, and then additional discoveries were added in a sequential manner. In the case of *Pseudomonas syringae*, it was first differentiated from similar bacteria because of its ability to cause plant disease. In the 1920's-1940's the plant host range and symptoms were described, with several hundred "species" being described, each "species" denoting the capacity to cause disease to a different plant host. In the 1960's a series of six biochemical and behavioral tests were used to differentiate *Pseudomonas syringae* as a group from other plant disease causing pseudomonads. In the early 70's some 200 physiological tests on hundreds of strains representing dozens of bacterial "species" resulted in a numerical taxonomy that holds today with minor adjustments, even in light of molecular phylogenetics.

The discovery of ice nucleation, its effect on plant frost injury and its unique structural protein occurred in the 1970's and 1980's. In the last 20 years the complete genomic sequence of several strains has been reported. There appear to be genetic "islands" of associated genes associated with a specific function – for example, the "pathogenicity island" which includes genes for hypersensitivity (secretion systems) and toxins. The genes for ice nucleation associated activities, for epiphytic/saprophytic growth appear to be independent and separate genetically from pathogenicity genes. Their involvement may be more associated with dissemination (how these bacteria get around). Our own focus has been on whether or not bacterial ice nucleation activities of *P. syringae* might facilitate their long distance transport, and whether or not the presence of this bacterium in clouds, rain and snow is just a set of spurious observations, or, in fact, is a very real unique and essential aspect of their survival. In an attempt to avoid our natural pathocentric tendencies – given that *P. syringae* was first described as a plant pathogen - we note that some *P. syringae* are associated with algae and insects and they may even have an airborne ecological niche as well.