Plant-associated fluorescent pseudomonads : their systematic analysis, microbial antagonism and iron interaction

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A thesis submitted in partial fulfillment of the requirements for the degree of DOCTOR OF PHILOSOPHY in Plant Pathology
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Abstract:
The plant-associated fluorescent pseudomonads are a potentially useful group of bacteria which serve as the focal point of several fields of applied research. The experiments reported represent the first systematic study of iron induced changes on microbial antagonism of these agriculturally important bacteria. A comprehensive numerical analysis which included data on 113 characters of nearly 200 isolates from a variety of plants served as the foundation on which the strain specific iron induced changes in inhibition were examined. Isolates tended to cluster on the basis of their host plant origin when characterized by carbon utilization tests. The numerical taxonomy was conducted in a manner which facilitated the evaluation of the relative merit of sole carbon source utilization tests, bacteriocin tests and antibiotic production tests in the characterization of strains. In addition, hypersensitivity response production in tobacco (Nicotiana sp.), phytopathogenicity in marigolds (Tagetes sp.), and ice nucleation ability of several isolates were determined. The ability of isolates to grow in the presence of 10.0 mM EDTA also provided data of taxonomic value. Strain variation and sectoring of colonies are discussed in terms of possible operative genetic mechanisms.

The isolation and partial characterization of an antibiotic from one isolate used in a novel treatment of Dutch elm disease revealed its ability to chelate iron and its similarity to siderophores and a phytotoxin, syringomycin. The previously unknown basic amino acid residues of syringomycin produced by Pseudomonas syringae were identified as δ -N-hydroxyornithine. Siderophore production effects both bacteriocin typing and production of fungistatic zones of inhibition by these bacteria. Antibiosis directed towards the eucaryotic organisms, Geotrichum candidum, Ceratocystis ulimi and a Rhodotorula species, increases for most pseudomonad strains on media containing iron. The results lead to the speculation that the iron status of plants and the ability of a pathogen to acquire iron may significantly affect the progression of some bacterial and fungal plant diseases and other microbial-plant interactions.