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Articulating microbiology with disease and community ecology to further understanding of pathogen emergence

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Abstract

Anticipating emerging plant infectious diseases (PIDs) and mitigating their impacts on host health are major socio-economic challenges. Accumulating evidence is demonstrating that PID emergence is mediated by multiple processes, including changes specific to micro-organisms, their biotic and abiotic environment and their dissemination both within and outside of agricultural systems. Management of emerging PIDs could benefit from the One Health concept that has greatly facilitated the understanding and management of emerging diseases of humans and animals due to its comprehensive integration of the ecology and biology of pathogens, and land-use considerations. The complex ecology of the bacterial plant pathogen *Pseudomonas syringae* provides a unique opportunity for developing such an approach for PIDs. This bacteria resides in a wide range of crop and non-crop plants, aquatic environments and in soil organic matter; and its dissemination is linked to the water cycle. *P. syringae* currently represents a complex of 13 genetic lineages of strains for which molecular tools of detection are available, allowing the analysis of *P. syringae* population structure. Phenotypic traits are highly variable and are involved in different stages of *P. syringae* life cycle as an epiphyte, saprophyte, pathogen and biological ice nucleator, an important property that underlies *P. synringae* role in rain and snow precipitation. For such a ubiquitous micro-organism as *P. syringae*, strategies of complete eradication are unrealistic. We will present a framework to assess how *P. syringae* abundance and communities can be regulated in crops in order to limit the emergence and dissemination of pathogenic strains while preserving the beneficial role of this bacteria in atmospheric processes. Specifically, we will test hypotheses on the role of i) trade-offs between phenotypic traits to explain the evolution of aggressiveness, and of ii) biotic (e.g. abundance and diversity of plant communities reservoirs of microbial diversification such as plant ground covers in fruit tree orchards) and abiotic environmental factors in pathogen emergence.

Key words: emergence, ecology, microbiology, pathogenicity, agronomy