Adaptive radiation of Pseudomonas fluorescens SBW25 in experimental microcosms provides an understanding of the evolutionary ecology and molecular biology of A-L interface biofilm formation

Combined experimental evolutionary and molecular biology approaches have been used to investigate the adaptive radiation of Pseudomonas fluorescens SBW25 in static microcosms leading to the colonisation of the air-liquid interface by biofilm-forming mutants such as the Wrinkly Spreader (WS). In these microcosms, the ecosystem engineering of the early wild-type colonists establishes the niche space for subsequent WS evolution and colonisation. Random WS mutations occurring in the developing population that deregulate diguanylate cyclases and c-di-GMP homeostasis result in cellulose-based biofilms at the air-liquid interface. These structures allow Wrinkly Spreaders to intercept O-2 diffusing into the liquid column and limit the growth of competitors lower down. As the biofilm matures, competition increasingly occurs between WS lineages, and niche divergence within the biofilm may support further diversification before system failure when the structure finally sinks. A combination of pleiotropic and epistasis effects, as well as secondary mutations, may explain variations in WS phenotype and fitness. Understanding how mutations subvert regulatory networks to express intrinsic genome potential and key innovations providing a selective advantage in novel environments is key to understanding the versatility of bacteria, and how selection and ecological opportunity can rapidly lead to substantive changes in phenotype and in community structure and function.

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