New insight into bacterial social communication in natural host: Evidence for interplay of heterogeneous and unison quorum response

Using novel QS-responsive *Xanthomonas campestris* pv. *campestris* (*Xcc*) bioreporters and cabbage as a model plant pathogen-host, Scientists at DBT's Centre for DNA Fingerprinting and Diagnostics (DBT- CDFD), Hyderabad have now demonstrated a detail lifestyle of the pathogen in which QS-regulated virulence associated functions are involved in adaptation at different stages of infection in its host plant. Here, team found a stage specific interplay of heterogeneous and homogeneous QS-response in the wild-type *Xcc* population *in planta*. During early stage of systemic infection, presumably under nutrient sufficient condition, QS-responsive cells contribute to spread and establishment of disease phenotype. The QS non-responsive cells act as free-loaders of QS-signal molecules, increasing the available signal strength for QS-responders within the population.

However, during the later stage of disease, presumably under condition of nutrient limitation due to the large increase in bacterial load, bet-hedging may be disadvantageous as the free-loaders share the limited resources. At this stage, QS-responsive cells have growth advantage probably by the production of 'private goods' required for survival under these condition. Our findings suggest that the interplay of heterogeneity and homogeneity in QS-response gives a stage specific adaptive advantage to the pathogenic bacteria within host environment during systemic infection.

Many microbes exhibit quorum sensing (QS) at a high cell density to cooperate, share and collectively perform multiple social tasks within the community, where QS regulates the coordinated production of exo-products as 'public goods' that are beneficial to the population as a whole. Such social tasks include the production of virulence associated functions such as components involved in biofilm formation, extracellular enzymes, extracellular polysaccharide and surfactants that promote motility and spread. Both animal and plant pathogenic bacteria significantly depend on QS-regulation to coordinate their colonization and infection of the host tissue for a successful disease establishment.

In general, QS-response and regulation has been studied under laboratory conditions *in vitro*, where the QS-responding bacterial population exhibits heterogeneous QS-response with the emergence of both QS responders and non-responders irrespective of their parental kind, as a

possible bet hedging survival strategy. It is believed that heterogeneity in performing social task may have adaptive functions, such as division of labour and sharing of environmental resources. However, very little was known about nature of phenotypic heterogeneity in bacterial QS-response inside the host. It was unclear whether the inherent stochastic heterogeneity in the QS-response exhibited under laboratory condition is influenced by change in environmental conditions, and whether there is selection pressure to cooperate under natural conditions particularly in host-pathogen interaction.

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