PLANT MICROBIOME

Phyllosphere dysbiosis

Nature http://doi.org/ggsg29 (2020).

Credit: GiroScience / Alamy Stock Photo

The phyllosphere refers to above-ground tissues in plants that provide habitats for various microorganisms. Many studies on microbiota in mammals and other systems have postulated the essential role of microbial diversity and balance in sustaining the health of host organisms; therefore, dysbiosis (microbial imbalance) can cause disease. Recently, a collaborative work from Sheng Yang He's group at Michigan State University, USA, and Xiu-Fang Xin's group at the CAS Center for Excellence in Molecular Plant Sciences, Institute of Plant Physiology and Ecology, Chinese Academy of Science, China, demonstrated a scenario of phyllosphere dysbiosis in *Arabidopsis* and proposed a possible mechanism underlying the observed shift of microbial diversity.

The *Arabidopsis* quadruple mutant (*min7 fls2 efr cerk1*), abbreviated to *mfec*, is defective in multiple plant immune pathways. As a consequence, mutant plants suffer from impaired immunity and display disease symptoms under several different soil conditions. To understand the relationship between leaf microbiota and plant health, Chen and Nomura et al. analysed the abundance, diversity and composition of leaf microbiota in the *mfec* mutant and the Col-0 control. Although data of total leaf microbiota are comparable between the two groups, they found a significant increase in the abundance of endophytic bacteria as well as a decrease in bacterial diversity in the leaves of the *mfec* mutant compared to the Col-0 control. In addition to the above analyses, their 16S profiling of the leaf microbial communities assisted to design the subsequent bacterial community transplantation experiments in which members of the leaf endophytic bacterial community, derived from either the *mfec* mutant (52 members) or the Col-0 control (48 members), are inoculated with healthy Col-0 plants or *mfec* mutant plants that grow under sterile conditions. Only the *mfec* 52-member bacterial community caused growth defects and disease symptoms, such as leaf chlorosis and necrosis, in Col-0 plants. Therefore, phyllosphere dysbiosis is likely an important negative factor that regulates plant health.

Further, Chen and Nomura et al. compared the effects of individual bacterial species on the development of disease symptoms in the leaves, and the findings suggest that the *mfec* endophytic population contains more devastating bacteria than the Col-0 population. More interestingly, they proposed that the shift of microbial community could be explained by the accumulation of the devastating species that cause growth inhibition of certain other species. Besides the pattern-triggered immunity and MIN7 vesicle-trafficking pathway that are known to be disrupted in the *mfec* mutant, the authors also showed the involvement of a potential downstream factor, *CONSTITUTIVELY ACTIVATED CELL DEATH1* (*CAD1*), in the regulation of phyllosphere microbial community. These highly conserved immunity regulators indicate possible conserved rules of interactions between the host and phyllosphere microorganisms in the plant kingdom.

Lei Lei

Published online: 5 May 2020
https://doi.org/10.1038/s41477-020-0674-7