PLANT–MICROORGANISM INTERACTIONS

Slimy symbiosis

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There is one 'Holy Grail' in plant biology. Researchers have been working on it for decades and hopes were renewed when genetic engineering became a reality. It is to introduce symbiosis with nitrogen-fixing bacteria in non-legume crops. These microorganisms, hosted in nodules on legumes' roots, transform the dinitrogen that is abundant in the air into molecules that plants can use. Non-legume crops, such as cereals, do not establish this symbiosis so we help them with considerable amounts of synthetic nitrogen fertilizer — a multifaceted problem in itself.

Instead of trying to engineer an artificial symbiosis from scratch, a possibility is to look for natural symbiotic situations occurring in nature, understand the complex relationship between plant and microorganism, and then try to extend this association to other plants and bacteria. This is the strategy followed by Allan Bennett and colleagues. They surveyed isolated maize landraces known to grow well without fertilizer near the domestication origin of maize in Mexico, where the genetic diversity is the highest. They focused on an unusual indigenous variety with many peculiar aerial roots covered with a viscous carbohydrate-based gel. Surprisingly, this slime contained active nitrogen-fixing bacteria. The authors estimated that up to 80% of the plant nitrogen nutrition came from these bacteria.

A lot of research is still needed, but breeding or transferring this capacity to other maize varieties — and possibly other cereals — as an alternative to root nodulation, could be a major advance in sustainable agriculture beyond countries with poor soil and low access to fertilizers.

Guillaume Tena

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