Do plants have a microbiome?

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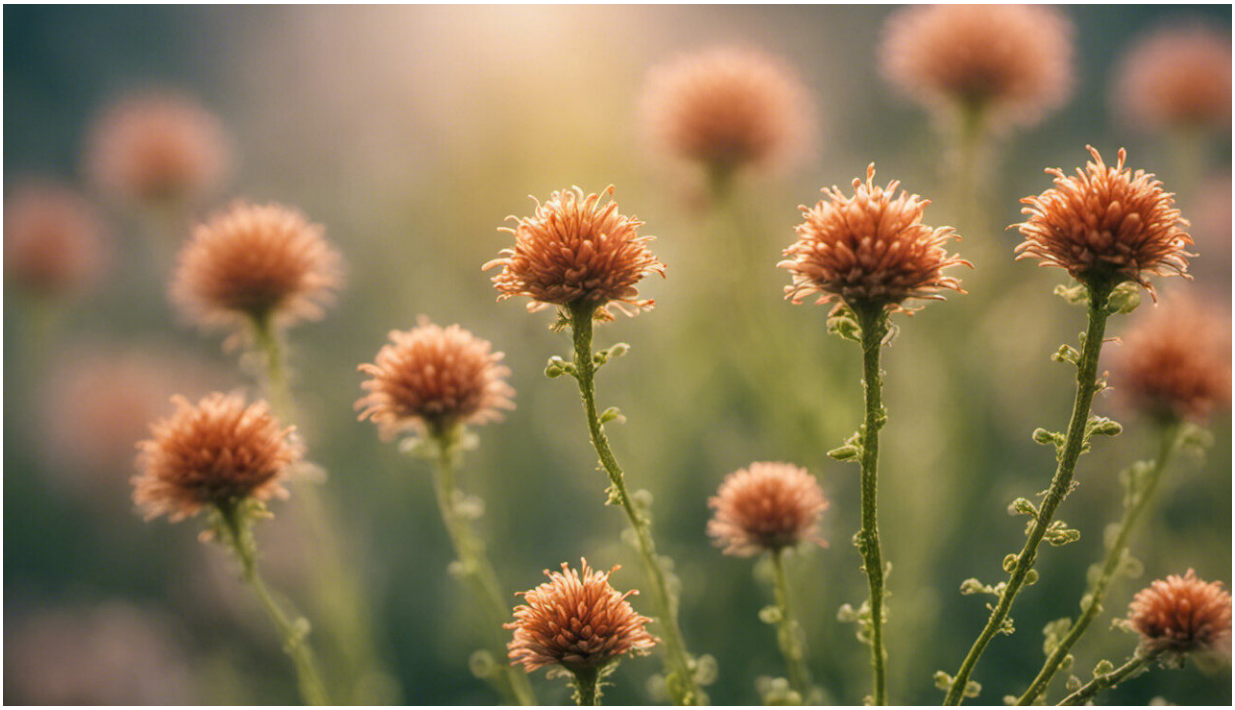

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Our bodies are home to trillions of invisible microorganisms, including bacteria, fungi, viruses and miniscule animals. These live on our skin, in our mouths, even within our cells, where they may contribute in numerous ways to our health and wellness. For example in our gut, bacteria help to break down potential toxic food compounds, and synthesize vitamins that we need.

"This is the microbiome," explains Marie Skłodowska-Curie fellow Tania Galindo from ETH-Zurich in Switzerland. She adds that she has just arrived from a conference in Vienna, "where speakers often pointed out that there are more microbial cells in our body than human cells."

But humans are not unique in being an ecosystem unto themselves. Since the very beginning of agriculture, farmers have understood that disease could spread from leaves or fruits of one plant to others. Evidently, some infectious force has been at play, impacting their harvests and livelihoods.

To understand more about plant microbiomes, scientists employed the same methods used in human clinical microbiology, isolating and characterizing infectious organisms to identify and diagnose diseases affecting plants.

How the plant microbiome can boost agriculture

These days, the field of phytopathology—the study of plant disease—is interested in the beneficial as well as negative aspects of microbes. The ROOTPHENOBIOME project that Galindo worked on is helping us understand how the many microbe species that live on, around and in plants—their microbiome—can help us achieve more sustainable agriculture.

"We know that there are groups of microbes in the soil and on the leaves that protect plants from disease and help them to acquire more resources," she explains. For example, bacterial groups in the soil such as actinomycetes help to decompose organic dead matter, enabling valuable nutrients to be taken up by plants.

"Another important group of microbes are the fungi called mycorrhiza," continues Galindo. "These soil-borne fungi have a symbiotic relationship

with the roots of many plants. They absorb and transfer nutrients from places in the soil that plant roots cannot reach, and displace pathogens." Research shows that plants with these fungi present in their microbiome tend to be healthier.

Scientists have also discovered nitrogen-fixing bacteria that live on and around the root, helping plants to fix more of this vital nutrient from the air. Nitrogen is part of the chlorophyll molecule, which gives plants their green color. You can often identify plants lacking in nitrogen by their yellowing leaves.

Research such as this, Galindo believes, can help to revolutionize agriculture. Consumer understanding and acceptance of gut health, for example, has led to huge demand for probiotic yogurts and other products that work in harmony with our microbiome. Why not apply this principle to crops?

"Selecting and managing microbes that suit specific plant species could help us to reduce the amount of chemicals and pesticides we are currently using," says Galindo. "This is really important, because at present, we are damaging the environment."

Galindo points out that farmers typically apply 150% of the nitrogen crops need because much of it will run off into waterways or be broken down by microbes and released as greenhouse gases before the plants can absorb it.

Deploying microbes that help plants to fix nitrogen could lead to significantly reduced amounts of fertilizer being spread on a field. "If we understand how microbes work, then we can use these microbes to complement or replace chemicals," she concludes.

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