Researchers identify micro-organisms that could help vegetables grow better

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(From left to right) Dr. Pavagadhi Shruti, Associate Professor Sanjay Swarup and Dr. Aditya Bandla with samples of choy sum at different stages of growth.

For vegetables to grow well, it is not enough to just give them sunlight and water. They need a whole community of micro-organisms to help

them grow healthily.

Now, a team of researchers from the National University of Singapore (NUS), led by Associate Professor Sanjay Swarup from the NUS Department of Biological Sciences, has identified almost 300 species of micro-organisms that grow together with common Asian vegetables. This is the first step towards helping high-tech urban farmers produce more crops with less chemical fertilizers.

Currently, what little is known in this field of research has been garnered mostly from standard plant species used in experiments, and they are non-vegetables. To address this gap, the NUS team collaborated with a commercial urban farm in Singapore. They obtained soil samples, as well as both the seedlings and mature plants of three common Asian vegetables—choy sum, kai lan and bayam. The microbes and their genetic material in the soil and on the plants were then extracted for analysis.

Assoc Prof Swarup, who is also affiliated with the NUS Environmental Research Institute (NERI) and the Singapore Centre for Environmental Life Sciences Engineering (SCELSE) shared, "Green leafy vegetables are nutrient-dense and packed with bioactive compounds known for promoting human health. These leafy greens are short-cycle crops, suitable for adoption in various farming formats. Focusing our research priorities on this food group will address food and nutritional security and cater to both quantity and quality aspects of food production."

The value of microbial diversity

The researchers sequenced the genetic material in the samples using a technique called metagenomics. It uses computational methods to analyze the diversity and characteristics of the genetic material without having to isolate and culture individual species of microorganisms. This

method gave them a comprehensive picture of the microbial community in less time and with less effort.

Using a supercomputer, the researchers identified almost 300 species of bacteria and a group of single-celled, bacteria-like organisms known as archaea. From the data, they found that the microbes could potentially benefit the vegetables by providing nutrients, stimulating growth and suppressing pathogens. The findings of the four-year study were recently published in the journal Scientific Data .

Real-world relevance

The project is in lockstep with NUS' key research area of Integrative Sustainability Solutions, as well as Singapore's goal of growing a third of its food locally by 2030.

Dr. Pavagadhi Shruti, the senior manager of the team who led the field sampling and laboratory work, and Dr. Aditya Bandla, the research fellow who led the computational work for the study, highlighted the importance of collaboration and integration to build resilient food ecosystems.

Dr. Pavagadhi said, "We have seen how food supply chains are adversely impacted by the COVID-19 pandemic. Therefore, we need urgent reformative actions to build greater food resilience and security. Through this study, we are taking the first step towards building innovative solutions to boost local production in a highly sustainable manner."

Building upon their research, the team will be conducting detailed studies to identify the best microbial strains for enhancing crop production. They also hope their findings will encourage further research to understand how micro-organisms enhance crop growth and find new

ways to cultivate these micro-organisms.

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