Microbes team up to boost plants' stress tolerance

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(Phys.org)—While most farmers consider viruses and fungi potential threats to their crops, these microbes can help wild plants adapt to extreme conditions, according to a Penn State virologist.

Discovering how microbes collaborate to improve the hardiness of plants is a key to sustainable agriculture that can help meet increasing food demands, in addition to avoiding possible conflicts over scare resources, said Marilyn Roossinck, professor of plant pathology and environmental microbiology, and biology.

"It's a security issue," Roossinck said. "The amount of arable land is shrinking as cities are growing, and climate change is also affecting our ability to grow enough food and food shortages can lead to unrest and wars."

Population growth makes thisresearch important as well, Roossinck added.

"The global population is heading toward 9 billion and incidents of drought like we had recently are all concerns," said Roossinck. "We need to start taking this seriously."

Roossinck, who reports on the findings today (Feb. 17) at the annual meeting of the American Association for the Advancement of Science in Boston, said that she and her colleagues found an example of a collaboration between plants and viruses that confer drought tolerance to

many different crop plants.

The researchers tested four different viruses and several different plants, including crops such as rice, tomato, squash and beets, and showed that the viruses increased the plants'ability to tolerate drought. Virus infection also provided cold tolerance in some cases.

A leafy plant, related to a common weed known as lamb's quarter, was also infected with a virus that caused a local infection. The infection was enough to boost the plant's drought tolerance and may mean that the virus does not have to actively replicate in the cells where the resistance to drought occurs, according to Roossinck.

In studies on plants that thrive in the volcanic soils of Costa Rica and in the hot, geothermal ground in Yellowstone National Park, viruses and fungi work together with plants to confer temperature hardiness, said Roossinck. Researchers found that fungi and a type of grass—tropical panic grass—found in Yellowstone National Park grow together in temperatures above 125 degrees Fahrenheit. If the plant and fungus are separated, however, both die in the same heat levels.

Because viruses are often present in plant fungi, Roossinck wondered if viruses played a role in the reaction.

"I noticed that all of the samples from the geothermal soils had a virus, so it seemed worth it to take a deeper look," said Roossinck.

The researchers found that there was no heat tolerance without the virus. Once the researchers cured the fungus of the virus, the plant was unable to withstand the heat. When the virus was reintroduced, the plant regained heat tolerance.

"A virus is absolutely required for thermal tolerance," said Roossinck.

"If you cure the fungus of the virus, you no longer have the thermal tolerance."

While researchers do not entirely understand the role of viruses in helping plants withstand extreme conditions, Roossinck said that future research may help the agricultural industry naturally develop hardier plants, rather than rely on chemical solutions that threaten the environment.

"The question is, can we restore the natural level of microbes in plants and grow them better and more tolerant of environmental stress like heat and drought, or pathogens?" Roossinck said. "This may lead to more natural methods of creating crops that are more heat, drought and stress tolerant."

Provided by Pennsylvania State University

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