E. coli adapts to colonize plants

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New research from the Institute of Food Research has given new clues as to how some *E. coli* strains, normally at home in mammalian gastrointestinal tracts, have adopted slightly different transmission strategies, with some being better adapted to live on plants than others.

In the light of recent outbreaks of food poisoning due to contamination of vegetables by dangerous strains of *E. coli*, this information will be useful to making sure our food remains safe. *E. coli* is most at home in the warm, moist, nutrient-rich environment found in the gastrointestinal tract of warm-blooded animals. But to disperse from one host to another these bacteria must get out into the world. There is evidence that some *E. coli* can survive for several weeks outside the host, and even grow in water or soil. But it is on plant matter that *E. coli* colonisation has become a concern, as although most types of *E. coli* are harmless, the presence of pathogenic strains on fruit and vegetables presents a food safety risk.

To find out more, the IFR team took the first comprehensive look at the differences between the populations of *E. coli* growing on crop plants and populations in the mammalian gut. Funded by the Biotechnology and Biological Sciences Research Council, they took over 100 isolates from leafy parts of vegetables growing in fields in England. Analysis of these showed that even within the same field the *E. coli* population is diverse and complex. They then compared these isolates with a standard reference collection of *E. coli* taken from mammals, including humans, from different continents. Profiling the two groups found a number of significant differences depending on the source of isolation. Compared

to the habitat inside the gut, a leaf surface is a hostile environment for gut bacteria. The temperature fluctuates away from the constant 37 °C inside our bodies, and there is a greater risk of drying out.

The researchers found that *E. coli* populations derived from plants tended to form biofilms more readily. Biofilms are complex structures formed by populations of bacteria coming together to make a thin film over a surface. They are held together by a protective extracellular matrix of proteins and sugars, and the researchers saw that there was also an increase in the production of components of this matrix in *E. coli* derived from the fields. These strains also used sucrose and other plant-derived sugars more than the *E. coli* populations derived from mammalian sources.

Biofilms might help to prevent *E. coli* drying out outside of its host and being able to take advantage of plant sugars could also aid their survival outside the main host, although overall the plant strains showed lower growth on the usual carbon sources *E. coli* uses.

An analysis showed that these differences are associated with previously defined phylogentic groups of *E. coli* showing that different environmental conditions have a selective effect in the evolution of different groups. While some have become more generalised, adapting to life outside the mammalian gut, others have remained specialised for life in this environment, avoiding the associated growth penalty. "While it was known that different environments harboured different *E. coli* populations, we now have an idea on how and why this happens," said Sacha Lucchini. "Knowledge of the mechanisms involved in plant colonisation by *E. coli* provides targets for developing strategies aimed at preventing potentially dangerous *E. coli* strains from colonising vegetables, thus keeping them off our plates."

More information: *Environmental Microbiology*

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