Disease Causing Irish Potato Famine Came From South America, Scientist Says

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Scientists at North Carolina State University have discovered that the fungus-like pathogen that caused the 1840s Irish potato famine originally came from the Andes of South America.

By comparing the sequences of both the nuclear and the cellular powerhouse, mitochondria, of nearly 100 pathogen samples from South America, Central America, North America and Europe, Dr. Jean Beagle Ristaino, professor of plant pathology at NC State, and a small team of researchers created “gene genealogies” that point the finger at an Andean point of origin for the pathogen, which is known as Phytophthora infestans.

The research is published online in *Proceedings of the National Academy of Sciences*.

Like family trees that genealogists use to trace family histories, the scientists used the pathogens’ gene genealogy to track migration patterns of the different strains, or haplotypes, of the pathogen. In essence, Ristaino, former grad student Luis Gomez-Alpizar and Dr. Ignazio Carbone, all of NC State’s Department of Plant Pathology, figured out how the pathogen’s genes changed over time and tracked these changes on maps that look similar to family trees.

“By studying the pathogen’s mutations, or changes in DNA, you can tell where the mutations originated and what strains spread to different parts of the world,” Ristaino says. Most of the early mutations occurred in

Peru and Ecuador in South America, according to the researchers' data.

Ristaino says there are a number of camps on the issue of the pathogen's center of origin. While 19th century scientists believed P. infestans came from South America, some present-day scientists believe Toluca, Mexico, to be the origination point. Early in the 20th century, Ristaino says, Toluca became a center for plant breeding studies, as scientists there collected potato seed from all over the world and tested it for resistance to the pathogen.

Ristaino says, however, that commercial production of potatoes did not exist in 1840s Mexico. In her more than 10 years of studying the potato pathogen in plants dating back centuries, Ristaino has also delved in shipping records and trade patterns. South American countries – mainly Peru – provided potatoes and potato seed to North American, Central American, European and Irish locales throughout the 19th century. In fact, Ristaino says, dry rot disease stymied potato production some years before the Irish potato famine, and Peru was called upon to provide tubers in response to the disease.

It's not hard to imagine diseased potatoes or potato seed being shipped from South America to the United States, Bermuda or Halifax, Nova Scotia, and then on to Europe, Ristaino says. "Potatoes were also part of ship stores to feed hungry sailors," Ristaino says.

Ristaino is no stranger to quashing prevailing theories about P. infestans. She called into question the assumption that the Ib strain of the pathogen – the pathogen has four strains, Ia, Ib, IIa and IIb – caused the Irish potato famine in a paper published in the journal Nature in 2001. Ristaino published findings that pointed the finger at the Ia haplotype in 2004.

P. infestans caused the Irish potato famine, which killed or displaced

millions of Irish people, and other late-blight epidemics across the world. It continues to plague modern potato and tomato plants.

Researchers from around the globe have joined forces to understand the pathogen and learn what makes the plant destroyer kill. Ristaino is part of a team that sequenced the entire genome of P. infestans recently at the Broad Institute at Massachusetts Institute of Technology in Cambridge in a collaborative project funded by the USDA and the National Science Foundation. The whole genome sequence data is important since it provides a complete genetic “parts list” for the organism; allows identification of new genes and comparison to other pathogens; allows study of the genomic landscape that clarifies how selection and evolution work; and contributes to our general understanding of water moulds, or Oomycetes, a branch of life extremely different from animals, bacteria and fungi.

Ristaino is now pursuing studies on the evolution of related Phytophthora species in the Andes to determine how they compare to P. infestans. “Many Phytophthora species thrive in the tropics and it’s possible they could be shipped here,” Ristaino says. “More understanding can help us prevent their introduction in the United States.”

Source: NC State University