Science Advances: Protein May Protect Rice from Bacterial Infection

Crop scientists think the newly-discovered protein could lead to ways to block the infection and grow rice using fewer pesticides.

24 July 2015 Nadia Ramlagan

AAAS NEWS NEWS SCIENCE MAGAZINE

IN THIS *XOO*-INFECTED RICE FIELD IN KURNOOL DISTRICT IN ANDHRA PRADESH, INDIA, THE YELLOW PLANTS ARE SUSCEPTIBLE TO THE BLIGHT, WHILE THE GREEN PLANTS ARE NATURALLY IMMUNE TO THE DISEASE. | RAMESH SONTI

The path to the discovery of a bacterial protein, one that appears to be essential for making rice plants resistant to infection, has been a long, twisty one for Pamela Ronald and her colleagues.

Their first attempt to identify such a protein uncovered lab errors that called their results into question and resulted in a two-year, painstaking project to find out what went wrong.

"We initially didn't want to get too excited," said Ronald, a professor of plant pathology and the director of the Laboratory for Crop Genetics Innovation at the University of California, Davis, speaking about the new results.

The findings, published in the 24 July issue of *Science Advances*, could be a game changer for preventing the bacterial blight of rice caused by *Xanthomonas oryzae pv. oryzae* (*Xoo*), which is among the most serious diseases of rice in Asia and Africa. More than half the world's people eat rice daily, and searching for ways to engineer more *Xoo*-resistant versions of the crop has been a challenge.

Like other plants, rice is armed with immune protein receptors designed to fend off attacks from different strains of a pathogen. Rice that carry an immune receptor called XA21 are protected from *Xoo* infection.

Ronald has spent decades studying the molecular basis of plant immunity. Her team had published a 2009 paper in *Science* that put forth a protein activator of XA21-mediated immunity, but they ultimately retracted the study in 2013 after they couldn't reproduce the results due to a mix-up of bacterial strains in her lab.

"I knew retractions happened to other people and it really never occurred to me that something like this would happen in my lab," said Ronald.

It took the authors nearly two years of re-doing experiments and performing new experiments to convince themselves that this time they had identified the correct molecule involved in the immune recognition between the XA21 receptor and *Xoo* — a bacterial protein called RaxX.

"We actually found RaxX in a gene region we suspected nearly 10 years ago, but had failed to identify a mutation that linked it to immunity," said Ronald.

This time, Ronald and her team focused on the exact chemical modification needed to activate RaxX, called tyrosine sulfation. Sulfation has emerged as an important modification for many biological processes and has even been shown to play a role in immunity against HIV.

Crop geneticists should now be able to engineer rice plants to recognize RaxX in *Xoo*, even in strains of the bacteria carrying mutated versions of RaxX. This has wide implications for agriculture, namely that farmers could spray far fewer pesticides.

But the collective efforts of her lab that led to the discovery following the dispiriting retraction are what Pamela Ronald speaks most passionately about.

"I am excited about the discovery itself, but I am most proud that our lab stayed together as a team.

That's something positive that came out of this and I think that's important for other scientists to know," she said.

[Credit for associated teaser image: Daniell Caddell]