Above: Foresters in Ireland look at the test results during field sampling.

N.C. State University develops portable plant pathogen test

By Hayley Lalchand
Ohio correspondent

RALEIGH, N.C. – Researchers at North Carolina State University have developed a portable plant pathogen detection test that can deliver results in the field in under 30 minutes. The test is designed to detect Phytophthora ramorum (P. ramorum), a type of water mold that infects rhododendrons and forest trees such as tan oak and larch. Researchers believe the technology can be applied to other plant pathogens.

"There are a lot of Phytophthora species (a genus of water molds) that can cause a lot of really devastating losses to agricultural, forest and nursery plants," said Amanda Mainello-Land, lead author of the published research and recent doctoral graduate at NCSU. "Having diagnostic tools that can find (pathogens) quickly can really help to prevent their spread over time. This test was designed for field-level detection of P. ramorum and is less expensive and uses less resources than lab assays."

Determining what pathogen plants are infected with is a lengthy and expensive process. Most traditional testing can take days to weeks in laboratories, delaying important decisions that need to be made to manage the spread of a pathogen. In the case of P. ramorum, the pathogen responsible for Sudden Oak Death, Ramorum Leaf Blight, and Ramorum Dieback, testing can take even longer because it is a quarantine pathogen. Quarantine pathogens are regulated by federal and/or state authorities because they pose significant threats to agriculture, natural ecosystems, and sometimes even the economy. These pathogens are subject to strict control measures to prevent their introduction, establishment and spread. The USDA's Animal and Plant Health Inspection Service (APHIS) is the primary

(N.C. State continued on page 21)

N.C. State

From Page 17

agency responsible for regulating plant pathogens.

"APHIS is interested in faster diagnostics because right now, the problem is samples from the field are sent to state diagnostic labs and from there, to (a national diagnostic and reference lab) and it can take weeks to get the answer," said Jean Ristaino, professor of plant pathology at NCSU. "(Our test) allows us to do in-field diagnostics and confirm first whether it's a Phytophthora and second, whether it's Phytophthora ramorum because not all Phytophthoras are quarantine pathogens. Some are more destructive than others, so we targeted the assay for P. ramorum."

The test is designed to be easy to use so it can be handled by people with varying degrees of expertise. To use the test, an infected sample of leaf tissue is combined with reagents in a tube. The reagent's properties can recognize DNA segments characteristic of P. ramorum. The solution in the tube is purple to start, and the solution must be warmed up for about 30 minutes at 65°C or about 149°F. If the sample is positive for P. ramorum, the solution will change from purple to blue. The mix also contains a fluorescent dye that can be visualized using a smartphone. In some cases, the test can detect disease before visible symptoms appear.

Above: Rhododendron leaves infected with P. ramorum.

Ristaino is interested in continuing to demonstrate the viability of the portable plant test. During a sabbatical, she took the test global, demonstrating its effectiveness in detecting P. ramorum in an Ireland forest in 20 minutes.

Already, Ristaino and collaborators have adapted the test to detect several pathogens that cause disease in tomatoes and potatoes, including late blight, Phytophthora root rot, early blight, tomato spotted wilt virus and bacterial spot. The test must be specific for the target pathogen, and in some cases, extraction methods differ. For example, a microneedle patch has been developed that works better for herbaceous plant tissue, like that of tomatoes. Ristaino believes the test can also be modified to work for other systems, like detecting viruses in animals.

"We're at the point where we're trying to get some companies to pick (the test) up and run with it," Ristaino said.

Still, there are challenges in widespread implementation that will need to be overcome as the technology is shared with various stakeholders. In the case of quarantine pathogens that are federally regulated, decades-old processes for identification are likely to be favored. Additionally, nursery growers might be hesitant to adopt a technology that could reveal that their products are diseased, requiring them to cull plants.

"Stakeholder involvement in the deployment of these sorts of assays is important so they are used more widely," Ristaino noted.