Iowa State University researcher returns from Brazil with genetic material to study Asian soybean rust

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An Iowa State University plant scientist has returned from Brazil equipped with the genetic material necessary to study the molecular interaction between a soybean plant and the Asian rust fungus.

It is one of the first studies to look at the molecular changes that occur in soybeans infected by the pathogen. Researchers affiliated with Iowa State's Plant Sciences Institute hope the investigation can someday lead to the development of a soybean variety resistant to the deadly pathogen.

Martijn van de Mortel, a post-doctoral research associate in the department of plant pathology, spent five weeks conducting the experiment at Embrapa Soja, Brazil's leading national research institution for agriculture.

In the greenhouse experiment, Van de Mortel sprayed Asian soybean rust spores on two soybean varieties. One variety has some resistance to the fungus, while the other is highly susceptible. Beginning a few hours after infecting the plants and continuing for several days, he extracted genetic material at timed intervals. The material -- RNA (ribonucleic acid) --is basically the working copy of the DNA. It gives a snapshot of the level of gene expression at the time the plants were sampled.

Van de Mortel said he wanted to capture genetic material at the earliest stages of the infection because the molecular interactions between the soybean plant and the rust fungus at that time are expected to be critical in determining the fate of disease progression.

Researchers believe the plant defense mechanisms may be activated in the resistant variety during the early stage of infection, while the susceptible variety is expected to lack effective defensive actions against the fungus.

Brazilian researchers Ricardo Abdelnoor (left) and Álvaro Almeida (center) with ISU scientist Martijn van de Mortel (right), who returned from Brazil with non-infectious samples of genetic material from plants with Asian soybean rust.

Beginning later this summer, the expression of more than 30,000 genes of each of the sampled soybean plants will be profiled at Iowa State's GeneChip®. Facility, using the RNA brought back from Brazil. The data obtained from this analysis will indicate which genes are turned on or repressed relative to the gene expression in non-infected control plants.

"We can see what the genes are doing in the highly susceptible variety versus the more-resistant variety. We can look at the defense responses that slow down the rust. In the susceptible variety, we can look for what the plant is not doing that enables the fungus to establish an infection. We can look at what genes make a plant more resistant or more susceptible to the fungus," Van de Mortel said.

The process will take up to two months. Then the researchers will have a significant amount of data to sift through.

"We want to get the information out to other researchers as soon as possible," Van de Mortel said.

Van de Mortel could not conduct the first part of the research in the United States because of the limited capacity of biocontainment research facilities for studying the highly infectious fungus. The U.S. Department of Agriculture Agricultural Research Service recently expanded capacity with the addition of a new biocontainment facility in Beltsville, Md. In the coming year, Iowa State researchers plan to perform additional experiments in collaboration with scientists there.

The RNA Van de Mortel brought back to Iowa State is not infectious.

The project is part of the Plant Sciences Institute's crop protection research initiative led by Thomas Baum, associate professor of plant pathology, and Steve Whitham, assistant professor of plant pathology.

The Plant Sciences Institute is dedicated to becoming one of the world's leading plant science research institutes. More than 200 faculty from the College of Agriculture, the College of Liberal Arts and Sciences, the College of Human Sciences and the College of Engineering conduct research in nine centers of the institute. They seek fundamental knowledge about plant systems to help feed the growing world population, strengthen human health and nutrition, improve crop quality and yield, foster environmental sustainability and expand the uses of plants for biobased products and bioenergy. The Plant Sciences Institute supports the training of students for exciting career opportunities and promotes new technologies to aid in the economic development of agriculture and industry throughout the state. The institute is supported through public and private funding.