FOUNDATION

THE BATTLE AGAINST THE FUNGAL KILLER FUSARIUM, THAT INVADES VASCULAR SYSTEM OF MORE THAN 100 CROPS

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PRINCIPAL INVESTIGATOR: ANTONIO DI PIETRO

Devastating plant diseases that infect plant vascular systems are on the rise, affecting agricultural production world-wide. People outside the world of Agriculture have most likely never heard of it, but for those in this field, it is a real headache. Fusarium oxysporum is one of the most important pathogenic fungi in the world, due to its ability to attack more than 100 different crops. It can go unnoticed in soil for more than 30 years and, when visible symptoms appear, it is usually too late to save the affected crops.

After the spores germinate in the soil, the fungus grows directly towards the root of the plant, and then colonizes its entire vascular system, the water and nutrient transport system of plants. Its very hard to defeat this fungus, as Fusarium has a high mutation capacity, so it is capable of developing new strains that affect new crops contributing to an expansion in host range. In fact, a new strain of this fungus Tropical race 4 (TR4) is currently imposing serious damage to a large part of the world's banana plantations, since the dominant Banana variety Cavendish grown world-wide is clonal, propagated from cuttings, and is genetically identical.

Although the initial phases in which the fungus penetrates the root and the advanced stages after colonization of the plant's vascular system are widely described, there is a critical and much less known intermediate stage, in which it must evade the plant's immune system, which is quite effective and in which most plant-pathogen dialogue occurs. Hence, this stage represents a crucial interface where the host likely surrenders itself against Fusarium.

The Foundation project seeks to identify the virulence genes of the pathogen responsible for infecting diverse hosts

Verifying exactly how the pathogen overcomes this defensive barrier is the goal of the Marie Curie 'Foundation' research project being carried out by the Fungal Pathogenesis Molecular Genetics group at the University of Cordoba. According to Genetics Professor and the head of the study, Antonio Di Pietro, it is suspected that the fungus produces essential immunosuppressive proteins called effectors, that likely mediate the colonization of diverse host plants. Identity of such proteins and their mechanism of action are unknown at present." This knowledge, "could allow to understand the plant processes this fungus targets to colonize multiple hosts promoting its entry into the vascular system of the plant."

For this, researcher Amey Redkar, a beneficiary of the project, has developed a method to extract the apoplastic fluid from the infected plants, a liquid that is found between the cells of the root and that contains the immunosuppressive proteins secreted by the fungus. The next step is to find the genes of the pathogen that code for these proteins, and suppress them, to identify the pathogenicity proteins responsible for the virulence of the pathogen.

Up until now these experiments have been carried out on arabidopsis, a model plant; banana, a crop of great economic importance; and tomato, a species with which the group has extensive research experience. "We have already identified some proteins and the technique to extract them has been standardised and has worked better than we thought," Di Pietro says. Efforts are now being made to understand the role of these identified genes in virulence to the fungus and the host processes they target during the initial phase of infection.

In any case, the battle against this dangerous pathogen will be a race against the clock. According to a recent report by the United Nations Food and Agriculture Organization (FAO), if the necessary measures are not taken, the tropical TR4 form of Fusarium alone could damage 36 million tons of banana in the next 20 years, inflicting 8.42 billion euros in losses.