Genomics to Combat HLB

By Rick Dantzler, CRDF chief operating officer

Many believe long-term solutions to HLB will involve genetically altered citrus cultivars that are HLB-tolerant or even resistant. This field of study is known as "genomics."

A citrus tree's DNA contains information on the tree's characteristics. DNA is found in the nucleus of the cell. It is double-stranded and coiled, like a twisted ladder. Other organelles (specialized structures inside the cell) also contain DNA, but most of the plant's functions are controlled by the DNA in the nucleus.

The DNA contains all the information necessary to sustain life. This information is stored in certain segments of the DNA known as genes. The genes are responsible for all functions within a tree. However, the genes present in the DNA cannot function on their own as they remain trapped in the nucleus, unable to move.

The specific genes in the DNA can, however, be copied into single-stranded mRNA, which are mobile in nature. The mRNA moves out of the nucleus into the cytoplasm (the part of the cell outside the nucleus) and goes to another organelle in the cytoplasm called the ribosome. This ribosome takes the information from the mRNA and produces proteins. Proteins are molecules that ultimately move out of the cell, performing certain predetermined functions, like combating HLB.

Genomics can be used in the fight against HLB. For example, in 2015, University of Florida Institute of Food and Agricultural Sciences researcher Manjul Dutt and his colleagues determined that inserting the NPR1 gene from Arabidopsis (a small flowering plant used by the scientific community as a model) into Valencia and Hamlin trees exhibited enhanced resistance against HLB.

The NPR1 gene is a key regulator of a process known as systemic acquired resistance (SAR). With SAR, a localized exposure to a pathogen (a bacterium, virus or other microorganism that can cause disease) results in whole-plant resistance to that pathogen. The SAR process in plants is similar to the innate immune system found in humans.

This year, Dutt, with CRDF funding, will test rootstocks containing the NPR1 gene to determine if the HLB resistance can be conferred to the budded, above-ground non-transgenic scion. Our hope is that the resistance in the rootstock will successfully reduce bacterial populations and prevent their subsequent upward transmission. Additionally, since SAR is a mobile process, we hope that the scion will be ready to defend against infection. If successful, not only would resistance to the scion be delivered, but one could argue that the fruit was not transgenic because the scion was not transgenic.

Early results indicate that resistance has moved to the scion, but this was detected only at the molecular level, not in *C*Las titer levels. This spring, when titer levels are more meaningful and measurable because the trees will be older, new samples will be taken. This is a project I'm following closely.