Early HLB detection by dogs

By Amir Rezazadeh

Huanglongbing (HLB), or citrus greening disease, has caused more than 70% decline in the production of oranges for juice and the fresh market in Florida. Once a tree is infected, there is no cure.

Early detection followed by a rapid response is important to avoid further spread of the exotic pathogen. Delayed detection of HLB can result in prominent and widespread epidemy in larger areas and populations of citrus, and subsequent losses of billions of dollars in the citrus industry.

Currently, the main ways to detect new plant infections are visual assessments and molecular assays. The visual assessment is not sensitive enough to detect infection in new plants. A molecular assay, called a polymerase chain reaction (PCR) test, is expensive and not applicable for a large number of trees. Despite its high accuracy, PCR tests require financial and human resources for sampling, lab work and processing.

ACCURACY AND SPEED

In a recent U.S. Department of Agriculture (USDA) study, trained dogs could detect *Candidatus* Liberibacter asiaticus (CLas), the pathogen that causes citrus greening. The dogs detected the pathogen with 99% accuracy, 86% sensitivity and 99% specificity. Ninety-nine percent specificity means dogs reacted only to Liberibacter pathogens and not to other bacterial, viral and fungal pathogens.

Dogs can detect the HLB pathogen rapidly (approximately 2 seconds per tree) and in real time compared to other methods such as PCR. Early detection is beneficial because when a citrus tree is infected, the pathogen distributes within the vascular system of the tree with an incubation period of a few months to one year before the disease symptoms can be visually observed. During this time, infected trees can serve as a source for vector transmission for other trees for months or years before showing symptoms detectable by human eyes.

In a study performed by a USDA scientist in Florida, trained dogs could detect infected trees after two weeks of inoculation of the trees by CLas. In comparison, a PCR test could detect 3% of inoculated trees after two months, 50% of infections at 16 months and 67% after 17 months. Because systemic infection within a tree takes several months or years, the pathogen may not be present in all tissues of a newly infected tree, which results in an error and less accuracy of the PCR method.

Additionally, dogs detect the volatile CLas scent both from tree foliage and roots simultaneously. In the PCR test, the samples are collected only from the canopy (foliage). The results from previous studies clearly show the capacity of early detection by dogs with high sensitivity and specificity.

HOW DOGS DETECT HLB

The CLas scent volatilizes from the tree canopy and infected roots. The scent is moved spatially, forming an odor gradient from the source that is the tree. Trained dogs identify the tree holistically by detecting the CLas scent. When detecting, they cannot determine the origin of the scent (i.e., a single leaf, root, stem or the entire tree if it is systematically infected). That is why early detection by dogs is possible even if only a few cells or part of the tree is infected.

Minimizing the time between infection and detection and spread in the host population is the main purpose of using detector dogs. Like any laboratory instrument, detector dogs need to be calibrated periodically. They are calibrated by exposing them to CLas-positive trees or scent pads that contain the scent signature of CLas to keep them with 98% accuracy of detection before deploying them again.

Although using detector dogs appears not to be valuable in Florida because HLB is already at an epidemic level, dogs can be used to detect the introduction of any new target exotic pathogens or pests.

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