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Orange Juice Amino Acids May Reveal Secrets to Quelling Citrus Greening Disease

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Amino acids in orange juice may hold clues to the mostly secret, highly successful attack strategy of a powerful plant pathogen. Recent studies of these compounds may pave the way to a safe, effective, environmentally friendly way to vanquish this orchard enemy.

Known as *Candidatus* Liberibacter asiaticus, this microbe causes citrus greening disease, also called “Huanglongbing,” or “HLB.” (See article on page 4).

Agricultural Research Service chemist Andrew P. Breksa III and University of California-Davis professor Carolyn M. Slupsky have compared the amino acid composition of juice from commercially grown oranges. They used nuclear magnetic resonance spectroscopy to study juice from oranges grown on either HLB-positive trees or HLB-negative trees. Their investigation is apparently the first to do so, the scientists say.

The research has yielded distinctive profiles of the kinds and amounts of 11 different amino acids in 3 types of oranges: fruit from healthy trees, symptom-free fruit from HLB-positive trees, and fruit with HLB symptoms from HLB-positive trees.

With further research, the profiles may prove to be “a reliable, rapid, and early indicator of the presence of the HLB pathogen in an orchard,” Breksa says. For growers, an early indicator of HLB would be valuable. Here’s why: HLB can be a silent killer, living quietly and undetected for years in a grove of oranges, grapefruits, lemons, or other citrus fruit. The amino acid profiles may have another use, as well. They may reveal clues to mechanisms underlying the microbe’s mode of attack.

“No one understands precisely how the pathogen overcomes the defense system a citrus tree can ordinarily mobilize when it’s under siege,” Breksa says.

Trees need amino acids for growth, development, and defense. But what if the HLB pathogen were causing havoc with the trees’ ability to create, use, and recycle these amino acids?

That information could be used as a starting point for a tightly focused counterattack strategy, Breksa points out.

Building up and tearing down amino acids is part of the everyday life of a citrus tree. For instance, a tree can convert the amino acid phenylalanine into cinnamic acid, a precursor to compounds thought to be important to the tree’s defense system. But juice from oranges of HLB-positive trees “had significantly higher concentrations of phenylalanine,” Breksa notes. “This means that the HLB pathogen may have interfered with the orderly conversion of phenylalanine to cinnamic acid.”

Another example: Juice from oranges grown on HLB-positive trees contained significantly less of the amino acid proline. Says Breksa, “When a tree ‘knows’ something is wrong, it synthesizes proline. In the case of HLB-infected trees, however, the pathogen might be outsmarting the tree by undermining proline synthesis.”

Breksa is based at the ARS Western Regional Research Center in Albany, California. He and Slupsky collaborated in the work along with Thomas G. (Greg) McCollum of the ARS Horticultural Research Laboratory in Fort Pierce, Florida. An article by Breksa, Slupsky, McCollum, and Anne M. Slisz and Darya O. Mishchuk of Slupsky’s lab documents the findings and was published in the *Journal of Proteome Research*.

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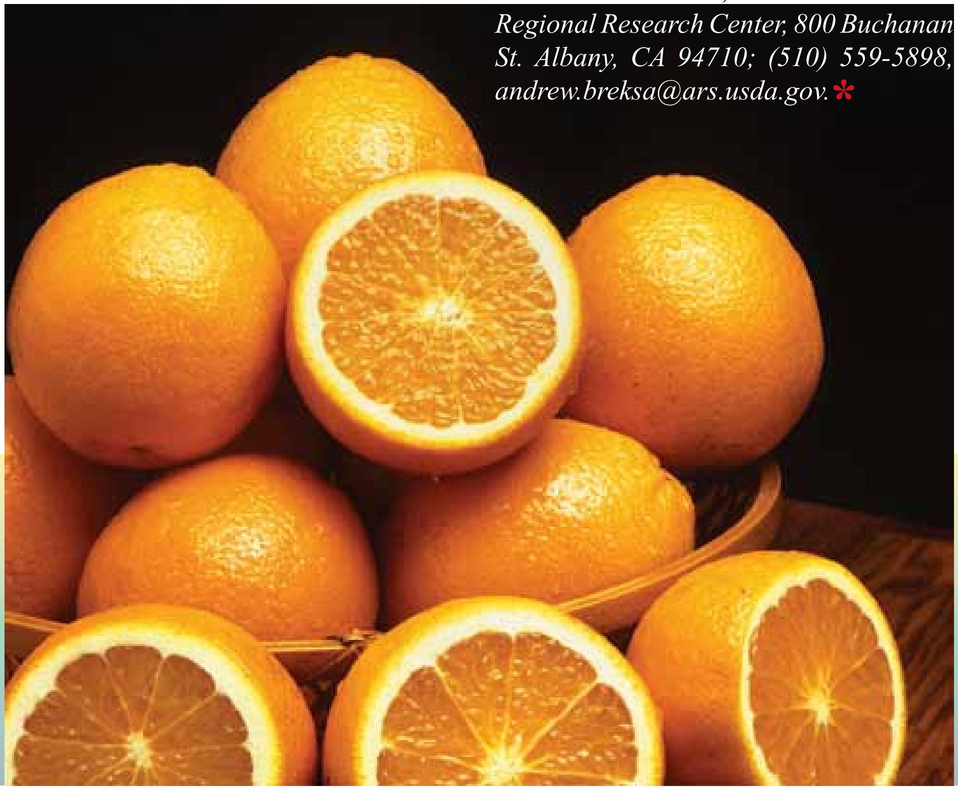

ARS and university researchers have found, in oranges, distinctive amino acid profiles that may be early indicators of the presence of citrus greening disease in orchards.

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