Control of Citrus Variegated Chlorosis by Pruning

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ABSTRACT. Approximately 20% of the citrus groves in São Paulo State are affected by citrus variegated chlorosis (CVC). The disease is caused by the bacterium *Xylella fastidiosa* which is readily transmitted by various sharpshooters. Trees are infected when they are fed on by infectious sharpshooter or when trees are produced using infected budwood; the bacterium subsequently spreads throughout the trees and the results in a non-productive tree. When trees over about 5 yrs of age become infected by sharpshooters, some individual branches of the trees will show symptoms, but most of the branches will show no symptoms for several years. The observation that the bacterium appears to spread slowly was confirmed by dot-immunobinding assays. The bacterium was readily detected in symptomatic leaves but was not detected 50 cm below the last leaf with symptoms on a given branch. Based on these observations, CVC was virtually eliminated from 552 hectares of sweet orange on Cleopatra mandarin rootstock by pruning 50 to 100 cm below any symptomatic leaves. Before pruning, approximately 15% of the tress had symptoms of CVC. After initial pruning, the trees were examined and pruned every other month for 6 months. The trees are now being examined and pruned annually. Very little CVC has been detected in the last 3 yrs and the trees are very productive. In contrast, significant losses due to CVC are occurring in groves on adjacent farms that have not been monitored or pruned.

Citrus variegated chlorosis (CVC) was first observed in Brazil in 1987 (5). Following the initial identification and description, CVC was found to be widely distributed in Brazil, suggesting it was being moved in infected budwood. The disease was also spreading from tree to tree in groves indicating movement by an aerial vector. CVC has subsequently been shown to be caused by a pathovar of *Xylella fastidiosa* and was readily transmitted through budwood (2). At present, CVC, is a major constraint to citrus production in Brazil. We report herein areas where the disease is very severe.

Trees propagated from infected CVC budwood will not become productive and will serve as a source of inoculum for other trees. Nursery trees should be closely inspected for symptoms; any trees with symptoms should not be planted in a grove. The best system for propagating citrus is to use buds from healthy trees. These source trees should be monitored regularly for symptoms and assayed for the presence of *X. fastidiosa* by serology or PCR (4). If possible, source trees should be kept under screen in areas that are free of CVC. Nurseries should be planted as far from existing groves as possible. Elimination of weeds in and around nurseries is very important, since sharpshooters reproduce on weeds that may be alternate hosts for the pathovar of *X. fastidiosa* that causes CVC.

X. fastidiosa moves in the xylem of infected plants, thus, the bacteria move upward much faster than downward in an infected tree (1). When a tree is inoculated by a sharpshooter, the bacteria moves up in the affected branch and symptoms will develop on the leaves of that branch. This movement of bacteria was confirmed by serological tests. Bacteria were readily detected in symptomatic leaves, but not in leaves that were 50 cm below the last symptomatic leaf on a branch. These observations led the development of the following procedures that have been used to very significantly reduce the incidence of CVC in existing groves.

Trees up to 5 yrs old. Trees under 3 yrs old with any symptoms of CVC should be removed. Trees between 3 to 5 yrs old may be saved by removing the affected branches if

only one or two branches are showing symptoms. Any tree, less that 5 yrs old, that has small fruit symptoms on any branch probably cannot be saved and should be removed.

Trees older than 5 yrs. Trees should be closely examined and every branch with any leaves showing symptoms should be pruned 50 to 10 cm below any symptomatic leaf. After initial pruning, the trees should be examined and pruned as necessary every 2 mo. This schedule should be continued until all trees in the grove are free of symptoms. The grove should be thoroughly examined annually, and any trees with symptoms should be pruned and monitored at 2-mo intervals until they appear to be free of the disease.

Using the procedures presented here, we have virtually eliminated CVC from 552 hectares of sweet orange on Cleopatra mandarin rootstock. Before these procedures were adopted, approximately 15% of the trees had symptoms of CVC. For the past 3 yrs, very little CVC has been detected and the trees are very productive. Significant losses due to CVC are occurring in groves on adjacent farms that are not using these procedures.

Obviously, CVC can be devastating, but by planting trees free of the disease, eliminating any young trees with symptoms and pruning older trees as symptoms develop, it appears that productive groves can be maintained, even in areas where CVC is very severe.

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