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CITRUS BLIGHT

Citrus Declinio in Brazil: Rate of Spread and Serological Comparison with other Declines

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ABSTRACT. Declinio is the most serious disease of citrus in Brazil causing an estimated loss of ten million trees per year. Declinio has all the diagnostic characteristics associated with blight in Florida: similar symptomatology, high zinc levels in the trunk wood, reduced water uptake, and the presence of blight related proteins. In one experiment in Brazil, the spread of declinio was monitored. The spread was exponential and 52.9% of the trees were affected after 65 months. Proteins associated with blight were found in trees affected with declinio in Brazil, but these proteins were not present in healthy looking trees or trees affected with other citrus declines including citrus variegated chlorosis (CVC) and Murcott collapse. Serological assays using antisera to the 12-Kda blight protein and to *Xylella fastidiosa* enabled declinio-affected trees to be easily differentiated from trees affected by CVC or Murcott collapse.

Declinio of citrus in Brazil is similar to citrus blight in Florida (3,5,7), blight in Cuba (13), and declinamiento repentino de los citricos in Venezuela (11,12). Declinio is the most serious disease of citrus in Brazil with an estimated loss of ten million producing trees each year (Amaro, personal communication), and the losses have increased exponentially over time. Declinio has all the diagnostic characteristics of citrus blight in Florida, such as similar field symptoms, high zinc levels in the trunk wood (15), reduced water uptake (8), presence of amorphous plugs (3), presence of blight associated proteins (4), and the disease has been shown to be root graft transmissible (1,11).

Citrus variegated chlorosis (CVC) is a new disease of citrus in Brazil. *Xylella fastidiosa* has been demonstrated to be the causal agent of CVC with the recent fulfillment of Koch's postulates (9), but the causal agent of blight is still unknown. Murcott collapse is a physiological problem associated with heavy bearing (10). The symptoms of Murcott collapse are similar to declinio and blight, but the trees have normal water uptake, there is no accumulation of zinc in the trunk wood, and there are no amorphous plugs present in xylem vessels (6).

The objective of this study was to compare the serological relationships of citrus declinio in Brazil with Murcott collapse, CVC, and citrus blight in Florida. In addition the spread of declinio was monitored in one location in Brazil.

MATERIALS AND METHODS

A grove of 1,253 Valencia orange trees on Rangpur lime in Minas Gerais State, Brazil, was selected for study. The grove was planted in 1981 on land not previously in citrus. Surveys for citrus declinio were conducted over 65 months on a regular basis (13, 51, 62 and 65 months) beginning in 1986 when the trees were 60 months old. There was no blight in the grove when the surveys began.

Water uptake, using the syringe injection method (8), was used to verify the presence of blight in the survey and for trees used in the serological comparison studies.

Mature leaves from 10 trees were collected for serological comparisons from: i) healthy and declinio-affected trees in northern Sao Paulo State; ii) healthy trees and trees with symptoms of Murcott collapse, in a grove in Mogi Guacu County, Sao Paulo State; and

iii) healthy and blight-affected trees in the Central Ridge area of Florida. All leaves were extracted using a leaf roller. The dot immunobinding assays (DIBA) were run as previously described by Derrick *et al* (4) using a polyclonal antiserum specific for the 12-Kda blight-related protein.

RESULTS AND DISCUSSION

The grove in Minas Gerais State which was selected for monitoring of declinio spread was surveyed for presence of declinio at 13, 51, 62, and 65 months after the first survey in 1986. At the last survey 663 trees were blight positive by visual inspection and confirmed by water uptake tests, thus 52.5% of the trees in the grove were affected. The percentage of trees affected at each survey are summarized in Fig. 1. The data of blight incidence fit the exponential model $Y = ae^{bx}$ where $a = 0.328$ and $b = 1.07$ and $R^2 =$

0.7. This exponential curve of disease increase is typical of many diseases caused by infectious agents.

In the serological comparison of diseases, declinio and blight, both reacted with the antiserum made against the 12-Kda blight-associated protein. CVC, Murcott collapse and healthy trees did not react. Antisera to *Xylella fastidiosa* did not react to leaf extracts from declinio-affected trees, but did react to extracts from CVC-affected trees in both DIBA and enzyme linked immunosorbent assays (Beretta and Lee, unpublished).

Blight in Cuba (7) and declinamiento repentino in Venezuela (2,11,13) have been shown to react serologically with the 12-Kda protein associated with citrus blight in Florida. Now that declinio in Brazil has been shown to contain the same blight-associated protein, we suggest that all these diseases should be referred to as citrus blight.

Fig. 1. The percentage of trees affected by declinio over a period of 65 months in a grove of Valencia orange on Rangpur lime rootstock located in Minas Gerais State, Brazil. The grove was planted in 1981, and monitoring for presence of declinio began in 1986 (60 months).

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