Tristeza-Like Decline in a Citrus Area of Santiago de Cuba Province and its Possible Causes

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ABSTRACT. The *Citrus tristeza virus* (CTV) surveillance program in Cuba has kept its incidence low for 10 yr. Unlike the rest of Cuba, in Santiago de Cuba province in the east, incidence levels remain under 10%. However, some plants with decline symptoms similar to those induced by CTV have been observed. To determine the relation of the decline to CTV, a survey of plants with symptoms was carried out. A Geographical Information System (GIS) was designed for the area with the highest values of virus incidence and declining plants. This tool was used to analyze the factors that may have influenced the decline observed. Thematic maps were obtained for relief, humidity, soil types, cultivars, CTV incidence and predominance of declining plants. The spatial distribution of tristeza in this area and the predominance of fields with infected plants in the initial stages of decline were observed. Fields in areas close to water courses showed a larger number of declining plants. Many of these plants were not CTV-infected, therefore a possible cause of the decline was the stress caused by the recent long drought in plants adapted to humid conditions. No relation between physical and geographical factors and disease behavior was found, so a CTV epidemic was ruled out as an explanation of the symptoms observed.

Citrus tristeza is the most important viral disease of citrus, due to the economic damage it causes. The presence of the complex *Citrus tristeza virus* (CTV)-*Toxoptera citricida* was detected in Cuba in 1993 and the surveillance program established allowed the country to maintain low CTV incidences. However, some plants on sour orange rootstock were observed to have decline symptoms similar to those induced by CTV (1). Unlike the rest of Cuba, Santiago de Cuba province maintains CTV incidence levels under 10%, although, numerous declining plants have been observed (5). To determine the relation of CTV to the decline, a survey of plants with symptoms was carried out. We surveyed all citrus fields in an area of 4,443 ha in Santiago de Cuba province. An arbitrary scale from 0 to 3 for tristeza-like symptoms was for analyzing the declining trees (5). To detect CTV, the samples were assayed by an Immunoprinting-ELISA diagnostic technique (4) using the monoclonal antibody 3C1F10. Additionally a Geographical Information System (GIS) was designed using AutoCad Map 2004 and ArcGis 9.2 systems for the area with the highest CTV incidence and number of declining plants, to analyze the factors that may have influenced the decline. The thematic layers of relief, humidity, soil type and territorial limits were digitalized. A data-base supporting GIS performance was developed with the following information: grove number, species, variety, rootstock, area, date of planting, yield, irrigation, soil type and survey results (symptoms in the plants sampled and CTV incidence in each field).

CTV incidence in the 43,144 trees analyzed reached 7.73% in the citrus area of Santiago de Cuba, indicating an increase with respect to the 0.62% obtained in the survey done in 1992-95 (3). The percentage of CTV infected plants according to tristeza symptoms 1 and 3 reached 20%. Grade 2 CTV symptoms were detected in 10% of the plants sampled, while less than 4% of the symptomless plants were CTV-infected.

No association was found between the decline observed and CTV infection, because only 15% of the trees with this condition were infected (Fig. 1). This low correlation indicated that the symptoms observed were caused by factors other than tristeza (horticultural and sanitary). CTV-infected trees without tristeza symptoms prevailed, and cases of quick decline were not found.

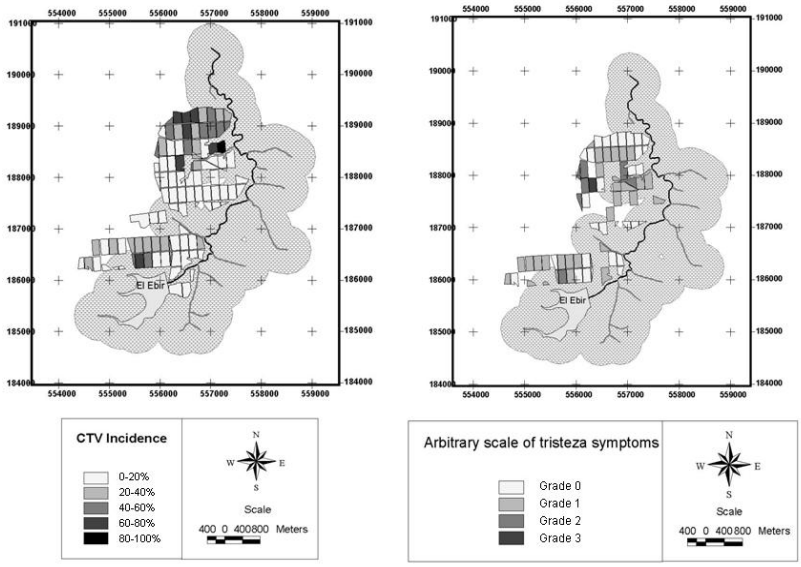

Fig. 1. A. Map showing CTV incidence *vs* hydrography. Light gray = low incidence through dark gray = high incidence. B. The same area showing predominance of decline symptoms *vs* hydrography; light gray (0: symptomless plants) to dark gray (3: plants dead or with zero yield).

The thematic maps obtained using GIS were compared with maps showing CTV incidence and predominance of declining plants. The spatial distribution of tristeza and the predominance of fields with infected plants in the initial stages of decline were observed. However, the physical and geographical factors analyzed did not show a direct influence on the disease behavior. Interestingly, the fields located in areas close to a physical depression showed a larger number of declining plants. Considering that many of these trees were not CTV-infected, a possible cause of this decline could be the stress on the root system (2) due to the recent long drought in plants adapted to humid conditions. Considering the absence of relation between the physical and geographical factors and disease behavior, a tristeza epidemic in this zone was ruled out as the cause of the symptoms observed.

Our results indicated a change in the epidemiological behavior of CTV in this province. Despite this, the eradication of CTV-infected trees without symptoms is still a feasible measure in this area because of its high effectiveness in groves with low CTV incidence.

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