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Tristeza in the Philippines

THE CITRUS INDUSTRY of the Philippines, composed mostly of the mandarin type (*Citrus nobilis*), is comparatively new. It is an offshoot of the citrus research project started in 1917 in the old Bureau of Agriculture, now the present Bureau of Plant Industry, Department of Agriculture and Natural Resources. The project then dealt mostly with the study of asexual propagation of citrus, introduction and acclimatization, and control of the then important pests and diseases of citrus. Citrus commercial planting was started just before the outbreak of World War II and greatly accelerated after the war.

Reports on the havoc caused by tristeza in California (2, 6) produced no little apprehension in the Philippines and had a retarding effect on our promising citrus industry. But the enormous profits to be derived from the thriving new industry, compared with those of other Philippine agricultural industries, together with the report (3) that tristeza was being effectively controlled with the use of resistant stocks like the Troy and Cleopatra mandarin (4) induced more people to go into it. At present, citrus culture has become a million peso industry in the Philippines.

In late 1958, calamondin (*Citrus mitis*) trees were reported to be dying in a grove in Sagnãy, Camarines Sur in the Bicol Peninsula, about 250 miles south of Manila. When an investigation was made by the personnel of the Research Division, Bureau of Plant Industry, 55 of the trees were suspected of having tristeza and were promptly rogued by the owner. No estimate of the extent of losses from the disease in the Bicol area or in the Philippines as a whole can be given at present.

Surveys are being made in various citrus plantations. Reports from Bukidnon in Central Mindanao indicate that a citrus malady similar to that in the Bicol region is present there.

Symptoms of the Disease

Symptoms of the disease in Sagnãy indicate strongly that the citrus trees are affected by tristeza. Tristeza, which in Portuguese means sadness or melancholy, has not been previously reported on citrus in the Philippines.

There are two generally recognized types of symptoms of tristeza—the less common type, which is characterized by sudden wilting and dying of the trees, and the more common type, which is characterized

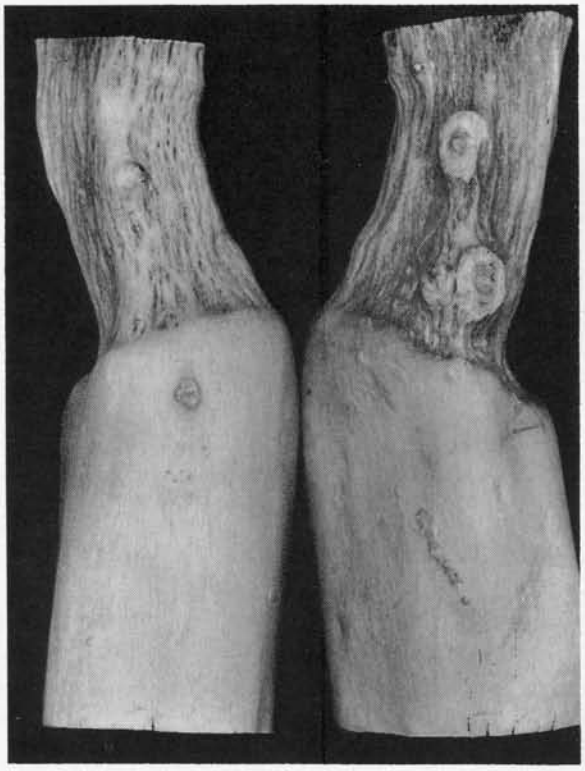

FIGURE 1. *Portion of a diseased calamondin tree on sour orange rootstock with bark removed to reveal severe stem pitting in the scion but no pitting in the stock.*

by a gradual decline. Gross symptoms in Sagnãy are of the latter type. As shown in Figure 1, stem pitting is found on the wood of the scion. The pits on the stem tend to coalesce and connect, developing twisted grooves parallel to the grain of the wood, resulting in the asymmetry in the calamondin scion stem. Stem pitting, as reported by other researchers (5), may appear on either scion or rootstock, or on both. The sour orange rootstock in Sagnãy is devoid of stem-pitting symptoms. Further laboratory diagnosis showed that the stem just below the bud union accumulated less starch than the scion just above the union.

Initial Transmission Tests

Initial tests of transmissibility were undertaken in the Guinobatan Experiment Station. In these initial tests grapefruit was used, since this and only a few other varieties of citrus such as the West Indian lime, some tangelos, pummelos, and some lemons show tristeza symptoms on their own roots. Greenhouse-grown, 2-month old grapefruit seedlings were budded on October 29, 1958, with buds from a diseased tree.

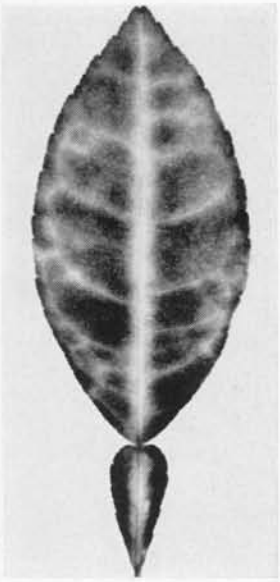

FIGURE 2. *Yellowing of veins in a leaf of a grapefruit seedling after artificial inoculation by budding with buds from a diseased calamondin tree. The photograph was taken 5 weeks after inoculation.*

Most of the seedlings, however, were very small at the time so that only 4 of the largest plants were used in the first trial; 2 were budded and the other 2 were left unbudded and designated as controls. One of the inoculated test plants showed vein-clearing symptoms on December 4, 1958, or 5 weeks after inoculation (Fig. 2). Intensification of vein clearing and flecking to yellowing along the main veins of the leaves developed later, very similar to tristeza symptoms described by other authors (1, 2, 6). The normal flushes of growth were totally suppressed, resulting in stunting. The other treated or budded seedling of this trial did not develop disease symptoms; instead it put forth normal vigorous flushes similar to the controls or check plants.

A second trial on grapefruit and calamondin, using the same method of inoculation, produced similar symptoms, as in the initial test. All 5 inoculated (budded) grapefruit seedlings showed vein clearing, later

FIGURE 3. *Severe stunting of grapefruit (left) and calamondin (center) seedlings that were inoculated by budding with buds from a diseased, field grown, calamondin tree. Noninoculated control plants are on the right.*

followed by flecking and rosetting of the stock. Severe stunting of all the test plants followed (Fig. 3). Similar symptoms were also exhibited by 4 of 5 calamondin test plants except that stunting was milder than that on the grapefruit plants. The incubation period of the disease was 46-52 days in the grapefruit and 44-89 days in the calamondin.

On September 6, 1960, one healthy pummelo seedling was bud-inoculated, using grapefruit seedlings infected in a previous test as donor. This plant came down with the disease after an incubation period of 51 days. The initial symptoms consisted of flecking of the leaves and rosetting of the stock. Again, on September 14, 1960, 2 healthy calamandarin seedlings were bud-inoculated and, while no foliar symptoms were observable on these plants, suppression of normal flushes and profuse gum exudation above the bud union were evident on one of them 45 days after inoculation.

Results reported above demonstrate that the malady present in Sagnãy is transmissible and suggest that it is tristeza.

Discussion

The occurrence of tristeza in the Philippines where citrus culture is comparatively new constitutes a serious threat to this promising industry. How the disease was introduced into the country cannot be ascertained. One can only surmise that it must have been introduced through diseased budwood brought in surreptitiously but innocently by zealous citrus planters.

After thoroughly evaluating the symptoms and potentialities of the malady together with the result obtained in transmission tests, the writers believe that prompt and vigorous measures should be undertaken to prevent possible spread of the disease to localities where it is not known to occur. At present, the formulation of an effective control program is handicapped for lack of information on the following: (a) the immunity, tolerance, and other reactions of the various local citrus varieties to tristeza; (b) absence of a survey on the extent of the disease, and (c) lack of information on rate and manner of spread of the malady.

To slow down or prevent further spread of the disease, a thorough survey of all citrus orchards should be carried out to determine the presence of tristeza and institute immediate removal of affected trees whenever they are found.

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This paper was read by P. A. Rodrigo, Assistant Director for Research, Philippine Bureau of Plant Industry.