

Observations on Stubborn Disease in Sicily

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THE PURPOSE of this paper is to report some further observations on stubborn disease in Sicily.

Symptoms of the disease were previously reported by Klotz (3) on sweet orange [*Citrus sinensis* (L.) Osb.] and by Ruggieri (4) and Scaramuzzi and Catara (5) on grapefruit (*C. paradisi* Macf.). In Sicily, the disease has been observed in the areas of Francofonte, Lentini, and Palagonia. It exhibits a wide range of symptoms, but affects comparatively few trees.

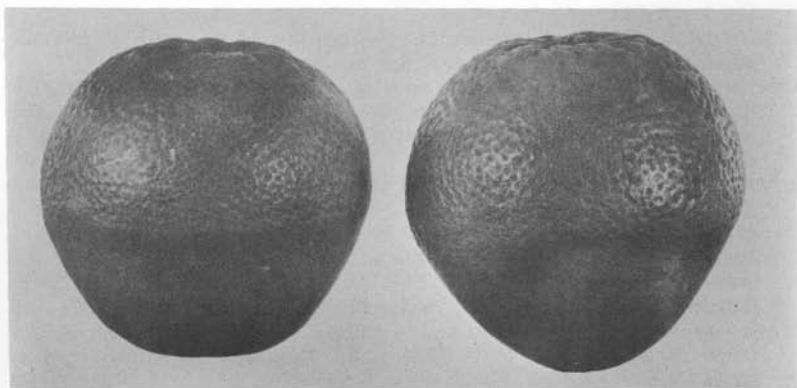


FIGURE 1. Acorn fruits of Tarocco sweet orange collected in the field.

Characteristic acorn fruits are seldom observed. However, such fruits were found on a few trees of Tarocco (Fig. 1) and Moro sweet orange, but did not appear every year. Lopsided fruits are more common on Clementine and other mandarins (*C. reticulata* Blanco). Styler-end greening has been observed on several citrus species and varieties, particularly on mandarin, Clementine, Ovale, and Tarocco sweet orange. On Ovale orange this symptom is found on abnormally elongated or cylindrical fruits. Fruits of the Sanguinello variety, having swollen peduncles, a symptom attributed to stubborn, were found occasionally.

Many suspected trees, exhibiting stunted growth, poor yields, off-season fruits, and small, mottled, cupped leaves that are often vertically positioned on the stem, are frequently observed in citrus groves. Neither seed abortion nor blue albedo of fruits has been found.

Methods and Results

To ascertain the identity of the disease, transmission tests were made in the field and in the greenhouse. Inoculation tissues, bark or buds, were taken from a Tarocco orange tree showing typical symptoms. The inoculum source was indexed for psorosis, exocortis, and xyloporosis. After 8 months, the psorosis tests were positive, the exocortis tests on Rangpur lime (*C. limonia* Osbeck) were negative, and indexing for



FIGURE 2. Reduction in growth of Eureka lemon budlings on sour orange inoculated with stubborn. Left: Non-inoculated check.

xyloporosis is still in progress. One year after inoculation, test trees in the field showed no symptoms of stubborn disease.

In the greenhouse, 12 sour orange (*C. aurantium* L.) seedlings were inoculated and subsequently budded with a seedling line of Eureka lemon. Non-inoculated check plants were subject to the same technique. After 3 months, growth of inoculated Eureka lemon budlings was retarded (Fig. 2), and leaf blades were small compared to those of the check plants. At the same time, 6 seedlings, 18 months old, of Cleopatra mandarin (*C. reshni* Tanaka), Rangpur lime, sour orange, and *C. volkameriana* were bud inoculated from the same inoculum source. The seedlings were not cut back, and the inoculation buds were not allowed to grow. After 1 year, the inoculated seedlings showed no appreciable

differences in growth or other symptoms on stems and leaves; however, the *C. volkameriana* seedlings exhibited a temporary reduction in growth in the fifth month after inoculation.

Discussion

Characteristic fruit symptoms of stubborn have been found in only a few cases in Sicily, but the number of infected trees may be much higher considering that the disease has been reported by other authors from other areas of Sicily, and that *suspected* stubborn infections are common in citrus orchards. Various factors, particularly climatic conditions, may influence expression of symptoms of stubborn disease.

The reduction in growth observed in transmission tests with Eureka lemon budlings agrees with the results obtained by Calavan and Christiansen (1) in California and by Cassin (2) in Morocco. The stunting effect observed in our experiments suggests the identity of our disease with stubborn reported in California and Morocco.

The temporary growth reduction noted on *C. volkameriana* seedlings suggests the desirability of further investigation of the susceptibility of this rootstock.

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